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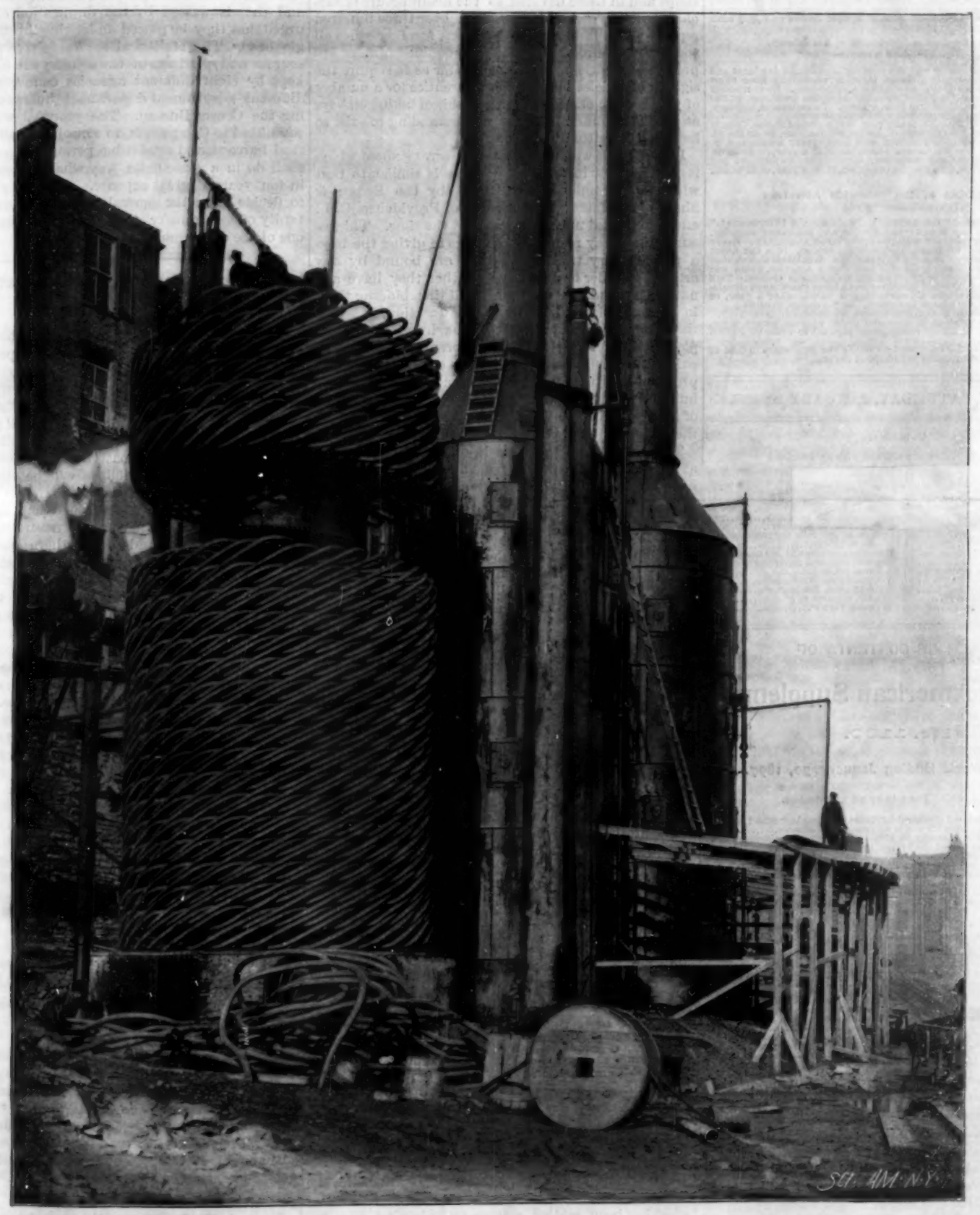
A TRIO OF ONE THOUSAND HORSE POWER BOILERS.

The giant water tube boilers shown in the accompanying illustration have been erected at the new station of the New York Steam Company, near the East River, between Fifty-ninth and Sixtieth Streets. They are the forerunners of a dozen other boilers of this type, which the company proposes to erect for the supply of the upper city. In the downtown plant there are in all fifty-nine boilers, the greater part of which are of the Babcock & Wilcox type. The company was formed to supply steam for heating and power purposes, and the total horse power of its present plant in New York City is 18,000.

Of the three boilers herewith illustrated, the two shown complete with their casing were built by the Clonbrock Steam Boiler Company, the other by the Columbia Steam Boiler Company, both of Brooklyn, N. Y. They are all of the Climax type, the Columbia boiler differing from the others chiefly in the "swell" or enlarged diameter given to the central standpipe at the water level, which is situated between the upper and lower nests of tubes. This was done with the object of maintaining a more even water level, and overcoming the violent fluctuations to which water tube boilers are liable. With this exception and the substitution of an air space for brick lining in the casing, the boilers are practically identical and conform to the well known Climax type.

Each boiler is erected upon a solid foundation of Portland cement concrete, 3 feet thick and 18 feet in diameter, and the whole weight of the boiler proper is carried upon a massive annular cast or wrought iron footing, 8 feet in diameter on the base, with an inside diameter of 5 feet. The inside of the ring is provided with an offset which serves as a footing for the bottom of the vertical standpipe or drum of the boiler, which is 60 inches in diameter, 38½ feet high, and is built of ⅜ inch steel plate, with a tensile strength of 60,000 pounds to the square inch. The standpipe carries 816 3-inch return tubes, which are bent to a bow shape, which corresponds very closely to that of the frame of a tennis racket. Each tube leaves the stand pipe radially, curves out and upwardly at the casing, and re-enters the standpipe 16 inches higher than, and one-third of the circumference distant from, the point at which it started. The tubes are a scant eighth of an inch in thickness. The grate is cir-

(Continued on page 68.)



A TRIO OF ONE THOUSAND HORSE POWER WATER TUBE BOILERS.

Scientific American.

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NEW YORK, SATURDAY, JANUARY 30, 1897.

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(Illustrated articles are marked with an asterisk.)

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Scientific American Supplement

No. 1100.

For the Week Ending January 30, 1897.

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PRESENT STATUS OF THE APPRENTICESHIP SYSTEM.

Since the date of our last reference to the apprenticeship system of the United States, the question has experienced one of its periodical revivals, and its pros and cons have received a very thorough discussion. The technical press, almost without exception, has opened its columns for correspondence and given the matter extensive editorial notice. It has also formed the subject of debate in trades unions, labor societies and the conventions of master workmen, and furthermore, it has lately been made the subject of carefully detailed report after examination by a committee specially appointed for the work.

After carefully following the discussion and gleaning the actual facts, as they have appeared from time to time, one is carried to the conclusion that the apprenticeship system is not so generally moribund as the state of affairs in some particular districts and trades would lead one to infer. This conclusion is borne out by the effort recently made by a committee of the Master Mechanics' Association to ascertain by circular letter the present status of apprenticeship in the railroad shops and in those devoted to the manufacture of machinery. The committee received over three hundred replies, which indicate that in some form or other all the leading railroads maintain a modified form of apprenticeship. Some of them go so far as to require the signing of articles binding the apprentice for a number of years, while others are in the habit of taking on boys at a small remuneration, the understanding to exist so long as it is mutually acceptable.

In general, it would seem that the arrangement which is most in favor in the United States is similar to that which was communicated to us by the Brown & Sharpe Manufacturing Company, of Providence, R. I., and commented upon editorially at the time. This, as our readers may remember, consists in giving the boys a probationary trial before they are bound by any articles, in order to determine whether they have any natural aptitude for the trade; and then binding them in an apprenticeship of three years' duration, in which the firm, in consideration of one hundred dollars, pledges itself to instruct the apprentice in the machinist's art and trade. If the boy complies with the provisions of the contract for the time specified, the one hundred dollars is returned; he is also paid at the rate of four cents an hour for the first year, seven cents for the second, and ten cents for the third year.

This plan, which we think is, on the whole, as good as any that have recently come under our notice, may be taken as fairly representative of American practice to-day. The chief modification has been in the direction of strengthening the inducement for the apprentice to serve the full time of his contract. This is being done in some cases by withholding a small percentage of his wages, instead of requiring a cash deposit in advance. The advantage of the former method is obvious, for, whereas the forfeiture of the deposit would probably affect only the boy's parents or guardians, the loss of his wages would tell upon his own pocket, and, as boys generally go, would be a proportionately stronger deterrent.

In all the discussion, verbal or written, of the past few months there are two encouraging facts which are clearly established and are full of promise for the future of the apprenticeship system. In the first place it is clearly recognized that while the root idea of the old apprenticeship was good, the system must be entirely revised in order to adjust itself to modern conditions, both mechanical and social. This is self-evident. Specialization in the machine shop on the one hand, and broader, more liberal views of the relation of master and man on the other, have rendered the seven years' "service" of the "bound" apprentice of former years neither desirable nor possible. We may regret the passing of the all round ability of the finished machinist of other days; but gone it is, and for the good reason that there is no call for such superfluous versatility. The modern methods of shop and factory management call for superior excellence in special lines of work, and the result has been that the length of the term of apprenticeship has been cut down fully one-half. At the same time the relations between employer and employed have been made more elastic, and they conform more fully to modern ideas. Moreover, the earning of a small wage has given a certain independence to a position in which the occupant was formerly too often treated with scant regard, if not with positive indignity.

The other fact in which we find much promise for the future is that, after carefully going through most of what has been said or written on this vital question since we last had it under review, and as the result of our own independent inquiries, it is abundantly evident that the modified form of apprenticeship which is now in vogue is a practical success.

As regards the trade and night schools and their relation to the system, we think, as before, that their work should be considered as both preparatory and supplementary to apprenticeship. If the tendency of modern apprenticeship is toward a too rigid specialization, the trade school will act as an effective corrective, giving the boys an opportunity to acquire knowledge, if not dexterity, in lines of work to which they do not have access in the shops.

A NATIONAL DEPARTMENT OF SCIENCE.

In a few days a formal recommendation will be submitted to Congress in favor of the establishment of one great scientific department of science in place of the several existing separate government bureaus, which are maintained at great expense for the promotion of science and the development of the resources of the country. Charles W. Dabney, Jr., Assistant Secretary of Agriculture, has prepared an argument favoring the consolidation of all the bureaus into one department. He shows that, aside from the government schools and the testing laboratories of the War and Navy Departments, the United States maintains no less than twenty-eight scientific bureaus for the development and advancement of industrial resources. These bureaus employ over 5,000 persons and are maintained at an expense of $8,000,000. As all of the bureaus have a common purpose, and considerable money and time is wasted by the duplication of work, it is urged that they be placed under the direction of a single head. The statistical records of the national resources and products of the country are collected and kept by eight different agencies connected with six different government department bureaus, not counting the Census Bureau. The proposal which is to be submitted to Congress is to consolidate all the statistical bureaus and establish a permanent census, which shall do in a systematic way what is now done once in ten years at great expense. Congress will be asked to decide upon the general programme, and as opportunity offers, transfer the different bureaus to some one of the departments.

THE HEAVENS FOR FEBRUARY.

BY WILLIAM R. BROOKS, M.A., F.R.A.S.

THE SUN.

On the first day of February there will be an annular eclipse of the sun. It will be visible as a partial eclipse in the United States, and as such only south of a line drawn from Boston in a southwesterly direction through the Middle and Southern States to the southern point of lower California. To all places north of this line the eclipse will not be visible. In the vicinity of the Atlantic coast from Charleston to Boston a small phase of the eclipse will be visible shortly before sunset. The path of annulus, from thirty-five to forty miles in width, extends from a point about 10 deg. east of the northeastern coast of Australia, across the South Pacific Ocean and the northern part of South America, ending on the northeastern coast of the last named country.

Along this path the moon will appear to pass centrally across the disk of the sun; but the relative distances of these two bodies from the earth are such at the period of this eclipse that the moon does not quite hide the entire face of the sun. At the moment of greatest obscuration there will be seen a narrow ring of sunlight surrounding the moon on all sides. Hence the designation annular eclipse.

An enormous sunspot has been visible on the sun's face during January, and it is quite likely to appear by rotation early in February, although it may be very much changed in both size and form. During its passage in January this spot was easily visible to the naked eye through a smoked glass. In the telescope it was, indeed, a fine object. The apparition of this great disturbance is remarkable, coming as it does at what is regarded as the minimum stage of the sunspot periodicity. All having telescopes properly arranged for solar observation should keep a watch on the sun at the present time.

The sun's right ascension on February 1 is 21 h. 2 m. 33 s.; and its declination south, 16 deg. 52 m. 33 s. On the last day of the month its right ascension is 22 h. 47 m. 41 s.; declination south 7 deg. 39 m. 56 s.

MERCURY.

Mercury is morning star, reaching its greatest elongation west of the sun, 26 deg. 23 m., on January 15. This will be the best time to look for Mercury as morning star, although its southern declination is unfavorable. The position of Mercury at that time will be, right ascension 20 h. 16 m. 30 s.; declination south 19 deg. 35 m. 16 s.

Mercury is stationary on the second, and in aphelion on the twenty-seventh day of the month.

VENUS.

Venus is evening star, and shines with regal splendor in the southwestern sky long after sunset. It reaches its greatest elongation, 46 deg. 39 m. east of the sun, on February 16.

Venus is in conjunction with the moon on the fifth of the month at 5 h. 43 m. in the afternoon, when Venus will be 3 deg. 48 m. south of the moon. This will form a most enchanting celestial picture, the moon being in the crescent phase at that time.

On the first day of the month Venus crosses the meridian at 3 h. 8 m. in the afternoon and sets at 9 h. 10 m.

P. M. On the last day of the month Venus crosses the meridian at 2 h. 58 m. and sets at 9 h. 45 m. P. M.

The right ascension of Venus on the fifteenth of the month is 0 h. 49 m. 27 s.; and its declination north 6 deg. 10 m. 22 s.

MARS.

Mars is evening star, and, being at a high altitude in the early evening hours, is well placed for telescopic study. Mars is yet in the confines of the constellation Taurus, through which it is moving slowly eastward.

On February 11, at 2 h. 43 m. in the afternoon, Mars is in conjunction with the moon, when the planet will be 1 deg. 51 m. south of the moon. On the 19th of the month there will be a conjunction of Mars and Neptune, when the latter planet will be 4 deg. 2 m. south of Mars. This will be a favorable time to pick up Neptune with a moderate size telescope. A magnifying power of 200 to 300 diameters will show a perceptible disk to the planet, which stars of about the same magnitude will not give. Thus by its different appearance among the stars Neptune may, with care, be identified.

On February 1 Mars crosses the meridian at 7 h. 56 m. P. M., and sets at half past three A. M.

On the last day of the month it crosses the meridian at 6 h. 44 m. P. M., and sets at 2 h. 25 m. A. M.

The right ascension of Mars on February 15 is 5 h. 0 m. 53 s.; and its declination north 25 deg. 26 m. 17 s.

JUPITER.

Jupiter is morning star until February 23, when it comes into opposition with the sun, or 180 deg. therefrom, after which date it is evening star.

It is in excellent position for observation, and many interesting details of its belts and satellites may be seen with even small telescopes. In the great telescopes Jupiter is a magnificent object.

The planet is in the constellation Leo.

On February 17, at 7 h. 3 m. P. M., Jupiter is in conjunction with the moon, when the planet will be 3 deg. 33 m. north of the moon.

On the first of the month Jupiter rises at 7 h. 15 m. P. M. On the last of the month it rises shortly before sunset.

The right ascension of Jupiter on February 15 is 10 h. 33 m. 57 s.; and its declination north 10 deg. 27 m. 24 s.

SATURN.

Saturn is morning star. It comes into quadrature with the sun on February 18, when it will be 90 deg. west of the sun. Saturn rises on the first of the month at 2 h. 10 m. A. M. and at the last of the month at 12 h. 30 m. A. M.

URANUS AND NEPTUNE.

Uranus is in the morning sky, and is in quadrature with the sun on February 17, when its position will be in right ascension 15 h. 47 m. 10 s.; declination south, 19 deg. 42 m. 41 s.

Neptune is in the evening sky, and its place is indicated in the section on Mars, with which planet it is in conjunction on February 19.

Smith Observatory, Geneva, N. Y., January 20, 1897.

The Plague in Bombay.

The eyes of the whole world are now turned toward India. Each day's news from the stricken land makes it apparent that another great tragedy is being enacted in the East. The heart of Europe has now been touched, and supplies are being hurried forward, though in many thousands of cases they will arrive too late. The famine in India has been caused by the failure of the crops owing to the small amount of rainfall. A very large proportion of the population of India is miserably poor, and the struggle for daily existence is hard enough ordinarily, so that when famine or any increased scarcity of food occurs, it is usually followed by an astonishingly increased amount of sickness and mortality.

Crowding close on the heels of famine came the bubonic plague, and to-day half the population of Bombay have fled from the city, and, unfortunately, they have nothing to support themselves on in the country, so that many must fall victims to the slower death by starvation. The death rate from the bubonic plague has risen to about one hundred and fifty per day in Bombay. In spite of the panic, many victims of the plague refuse to accept medical aid, regarding the disease as a visitation of God.

The difficulties of sanitary administration arise from the rapidity of decomposition of organic matter, the density of population, and the primitive habits of the people, which have never been brought in line with the necessities of a closely inhabited town having in certain wards a density of 760 per acre. In addition to the fixed population there is a constant current of immigrants coming from the mainland, mostly of the laboring class, who remain for a time to benefit by the well paid labor of the city and who return to agricultural occupations. These people know nothing of sewers, latrines, waterworks, or conservancy regulations. They seek lodgings in the densely crowded parts of the town, and the men will often join, eight together, in the hire of a single room, ten feet square and eight feet high, in which they will sleep together with door and window shutter closed during the rainy season. In a city with the climatic conditions of Bombay, and with such a dense population, the sanitary rules should be stricter and the individual compliance with them more complete than is the case in Europe if the death rate is to be kept within reasonable limits. The reverse, however, is the case, and the city appears always to exist on the verge of an epidemic of some sort.

The customs of the natives add to the hideousness of the plague. The Mohammedan cemeteries are overcrowded, and it is impossible to find men enough to dig graves and bury the dead. The sound of dirges is incessant in and around the places where the Hindoos burn their dead, in accordance with their time honored custom, and the funeral music has a most depressing influence on all who hear it, natives and foreigners alike. It is stated that numbers of dead bodies of Parsees, the religious sect who expose their dead to be eaten by the vultures, are slowly decomposing in the open air in the places in which they are left. They have not been eaten by the vultures, the birds having been overgorged by the great abundance of corpses furnished to them.

Everywhere the greatest difficulty is experienced in obtaining men to carry the dead to the cemeteries, the Dokhornas or "Towers of Silence," and the "Burning Ghats."

The point which most interests Europeans is whether the awful disease is likely to flourish in northern latitudes if the infection is introduced there; but no evidence is forthcoming as yet. It is argued by medical men, however, that if the plague is dangerous in Hong-Kong, it would find an equally prolific field in London and Paris as far as climate is concerned. It is generally admitted that the plague is a filth disease, but there are certain peculiarities connected with its spread. Dr. Haffkine, the well known bacteriologist, who is investigating the subject in Bombay, fastens the responsibility for carrying the infection upon rats, ants and other vermin and insects with which houses are infested. Rats have the plague. They die and are eaten by ants, which carry the germs into the crevices of buildings and to watertaps and sinks. Thus the poison is diffused and cannot be eradicated except by fire. This explains the efficacy of the old method of cleansing by conflagration, and, at the same time, the futility of isolating the sick as in other infectious diseases. The only thing to do is to remove the healthy. Dr. Haffkine has, it is said, proved the efficiency of attenuated plague virus as an antidote for the disease.

Dr. Yersin, a French physician, claims also to have discovered an antidote for the bubonic plague. In the course of an interview with a writer of the Monde Illustré Dr. Yersin said: "This plague is really the cleanest of all diseases. The patient has a little fever, feels a slight fatigue, a boil makes its appearance and after a few hours of suffering he dies without any of those repugnant complications peculiar to other epidemic diseases."

The doctor has also studied the bacilli of the plague. "The pulp of the buboes," he said, "is in every case filled with a veritable mass of short and stout bacilli, with rounded heads. Sometimes the bacilli appear as if surrounded by a capsule. They are found in large quantities in the buboes and ganglions of the patients."

Dr. Yersin concluded that inoculation of a more virulent variety of the specific bacillus would give immunity against the plague, and after first experimenting on animals he was equally successful later with human beings. These experiments, as stated in the New York Herald's dispatch from Bombay, are in the same direction as those made by Prof. Haffkine.

The conclusions drawn from a study of the spread of plague are as follows, says the London Lancet: I. Varieties: 1. The varieties of plague known under the names of (a) fulminant, (b) typical, and (c) pestis minor are allied. 2. The cause of fulminant and typical plague is a diplobacterium in the blood and tissues. The cause of pestis minor may be allied diplobacterium, but with a lesser toxic power. 3. An appropriate name for the fulminant and typical plague is "malignant polyadenitis." An appropriate name for the mild variety (pestis minor) is "benign polyadenitis." II. Infection and contagion: 1. Plague is infectious chiefly by the dust arising during the cleansing of dwelling houses which plague patients have occupied. 2. Plague is contagious by prolonged and intimate contact with the plague stricken, as in the case of a nurse carrying a child ill of the disease. III. Distribution: 1. Plague is met with in a definite area of Asia which may be termed the "plague belt." 2. That the home of plague at the present day is Mesopotamia and the countries adjacent. 3. From Mesopotamia as a focus the plague may spread northward to the Caspian Sea, westward to the Red Sea, southward as far as Bombay, and eastward as far as (Formosa) the China Sea. 4. During the present century plague has shown a western retrocession and an eastern accession of virulence. IV. The bacillus: 1. Typical plague (malignant polyadenitis) is associated with pestis minor (benign polyadenitis). 2. A bacillus of somewhat similar appearance microscopically is reputed to be found in both. 3. The bacilli differ in their toxic powers only (?). 4. A benign polyadenitis may run its course without being preceded or followed by the malignant variety. 5. Malignant polyadenitis may run its course without being preceded or followed by the benign variety. 6. The bacillus of the benign variety attains malignancy by passing through some intermediate host, possibly, but not probably, the rat.

It would not be surprising if within a month a genuine plague panic should spread through Europe, and Italy has already summoned an International Conference to meet at Rome to consider measures for dealing with the danger. The Indian mail arriving in New York has been fumigated before being assorted.

Recent Patent and Trademark Decisions.

American Cereal Company v. Eli Pettijohn Cereal Company (U. S. C. C. A., 7th Cir.), 76 Fed., 372.

Preliminary Injunction.—A preliminary injunction is somewhat in the nature of a judgment, and execution before trial, and, therefore, should not be granted except in cases of pressing necessity, and then the right to do it must be clear and the injury must be grievous. Generally, where the injury may be measured in money, the infringer or wrong doer should be shown to be pecuniarily unable to respond in damages. Hence, the trade name "Pettijohn," used in connection with certain prepared cereal foods, where the complainant's exclusive right to the name seems, upon the evidence, doubtful, will not be prohibited by a preliminary injunction.

Dickinson v. A. Plamondon Manufacturing Company (U. S. C. C., Ill.), 76 Fed., 456.

Brick Machines.—The Thomas patents, No. 315,855 and No. 375,660, and the Brewis patents, No. 324,453 and No. 395,871, must be limited strictly to the particular mechanism set forth. In them the machines operate by filling and compressing pulverized clay in plungers that approach each other by varied relative motions; hence they are not infringed by a device which, while accomplishing the same result in much the same way, is, however, mechanically different and in point of strength and durability very superior.

Seaberry v. Johnson (U. S. C. C., N. J.), 76 Fed., 456.

Construction and Limitation of Claims.—Courts are bound by the language chosen by the inventor in the statement of his claims of invention, and they do not have either the right or the power to enlarge them, even where the patentee had been really entitled to more than the terms of the claims would include. For example, in this case the patent is for an improvement in disinfectants consisting of a particular form of sulphur candle, and while in the description he speaks of a certain band as "preferably of metal," in the claim he mentions only "a surrounding band of metal." Hence he must be limited to his statement in his claim, and his patent was not infringed by a candle provided with a paper band so treated as to be incombustible.

Improvement in Disinfectants.—The Shaw patent, No. 390,314, has been construed and limited to the specific terms of the claim.

Foster v. Bent (Comr.'s Dec.), 77 O. G., 1781.

Amendment of Preliminary Statement.—In order to amend a preliminary statement, the party must present facts furnishing the same grounds for amendment as is required in modern court practice in amending pleadings. It is never proper to allow a preliminary statement to be amended as a matter of course without first showing the facts to justify it, and in considering the amendment it should not be disposed of on affidavits alone, but upon the entire record. An amendment should be permitted where undisputable facts show, beyond doubt, that a mistake had been made that would defeat justice, and where such facts, by the exercise of reasonable diligence, could not have been found and were not found earlier. Where the party did not give the preliminary statement adequate study or follow back the details in his own mind, but confused the article which he afterward made with the one he then invented, are not sufficient grounds for an amendment.

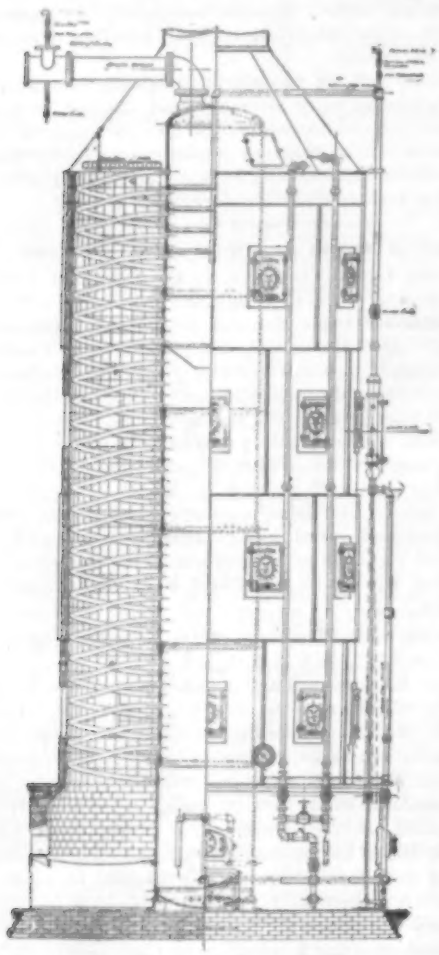
A Vegetable Pumping Engine.

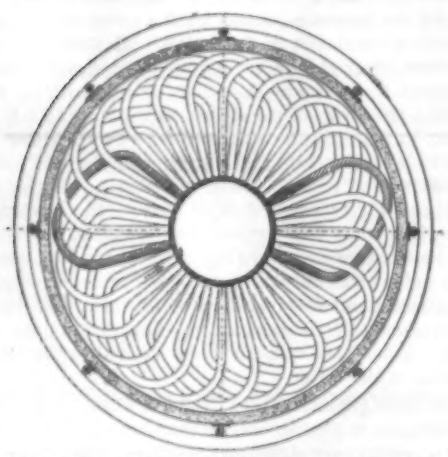
This is the title bestowed upon the ordinary tree by Sir Benjamin Ward Richardson. In a recent address, quoted in Cassier's Magazine, he says: "Hydraulic engineers would be sorely puzzled to explain how the large quantity of water required to supply the evaporation from the extended leaf surface is raised to heights up to 400 feet and above. We know that the source of energy must be the sun's rays, and we know further that, in the production of starch, the leaf stores up less than one per cent of the available energy, so that plenty remains for raising water. Experiments have shown that transpiration at the leaf establishes a draught upon the sap, and there is reason to believe that this pull is transmitted to the root by tensile stress. The idea of a rope of water sustaining a pull of perhaps 150 pounds per square inch may be repugnant to many engineers, but the tensile strength and extensibility of water and other fluids have been proved experimentally by Prof. Osborne Reynolds and by Prof. Worthington and others."

A TRIO OF ONE THOUSAND HORSE POWER BOILERS.

(Continued from first page.)

cular and sixteen feet in diameter, the firebox having an outside diameter of eighteen feet. The firebox and boiler are completely inclosed in a plate steel cas-





SECTIONAL VIEWS OF ONE THOUSAND HORSE POWER CLIMAX BOILER.

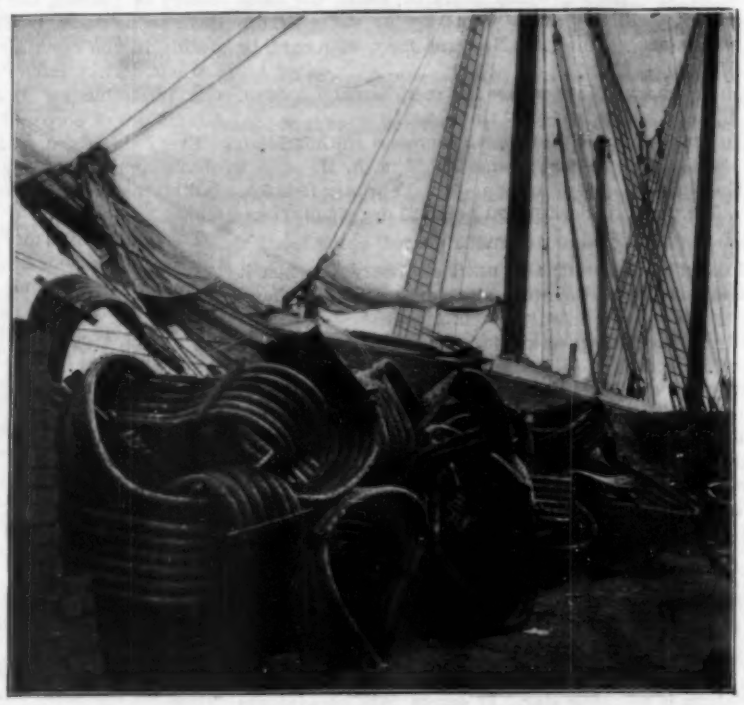
ing which rests upon the outer edge of the concrete foundation. In the case of the Climax boilers the shell is lined with 3 inches of firebrick, and in the Columbia boiler the radiation of the heat is to be prevented by an air space inclosed within a double shell. The total height of the casing is 40 feet; and the smokestacks, which are 5½ feet in diameter, rise to a height of 80 feet above the hoods, or about 125 feet from the ground. Within the hood is located a feed water heater consisting of a coil of 3 inch pipe, with a heating surface of 150 square feet.

From the above description it will be understood that the grate is annular in plan, extending from the outside casing to the central standpipe. The total grate surface is 160 square feet and the total heating surface for the whole boiler reaches the enormous figure of 10,000 square feet. The inner ends of the grate bars are carried on a ring riveted to the standpipe, and the outer ends are carried by the outer casing. Boiler No. 2 is fitted with St. John's wire screen shaking grate, which is the invention of Mr. St. John, the vice president of the New York Steam Company. As its name implies, this grate is of the rocking type; but instead of the customary cast iron bars which form the surface of the ordinary grate, the separate units of the St. John grate consist of an outer cast iron frame which is filled in with a wire screen. The screens are of No. 8 wire, with a ⅜ inch mesh. It will readily be understood that by the substitution of wire for cast iron the total air space has been greatly increased, the average for a cast iron grate being 35 to 40 per cent, whereas it is claimed that this grate presents as high as 65 per cent of air space. The wire screen was adopted as the result of a series of experiments in which it was found that the tendency of the cast iron bars to burn out was lessened as their thickness was reduced. When the minimum thickness of cast iron had been reached the wire screen was tried experimentally and proved to be a great success. The small section of the metal and the abundant rush of cold air effectively prevent any burning of the wires. The grates burn about 26 pounds of No. 1 Buckwheat coal per square foot per hour. There are six fire doors and six ash pit doors to each boiler, and the doors which will be seen in the casing give access for cleaning the tubes.

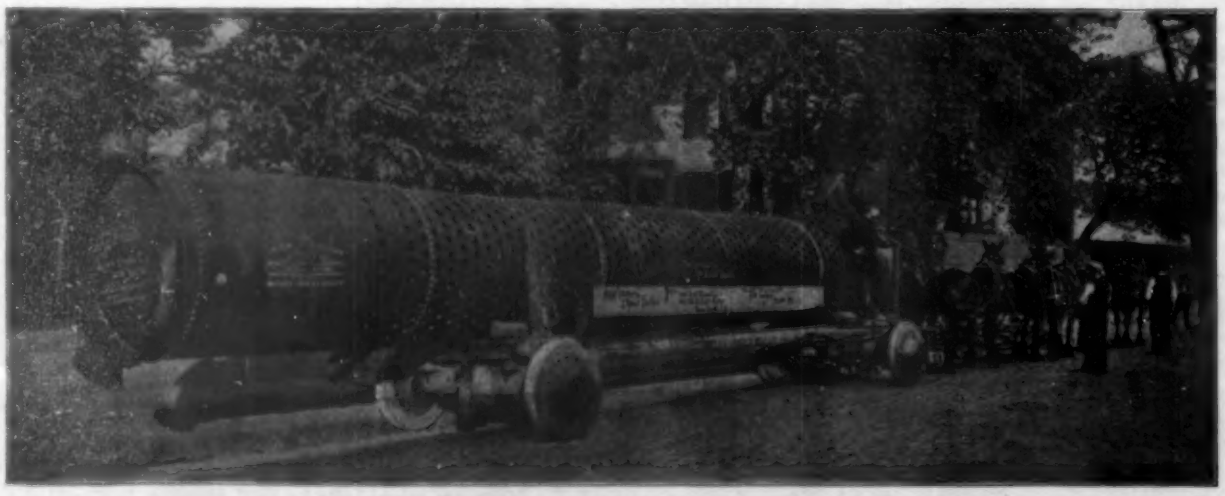
Subjoined are the results of a test of a similar boiler—Morrin Climax—recently made by Mr. G. C. St. John at the Dey Street station of the company in New York:

Length of test	5¼ hours
Amount of water consumed	196,562 pounds
Coal burned	21,380 "
Average temperature of feed water	129 degrees
Kind of coal used	Shamokin No. 1 Buck
Evaporation per lb. of coal actual	9 pounds
Horse power developed	1,229
Evaporation from and at 212 degrees	10 pounds

For the purposes of the test the boiler was connected up to a meter, which was carefully corrected by running the water through the meter into a tank on scales. The coal was weighed to the boiler from scales which weigh all the coal that goes to the station. The quality of coal was what is known as Shamokin No. 1 "buck." On another occasion 1,000 horse power was developed on the boiler with a fire burning "rice" coal.



A SHIPMENT OF CLIMAX BOILER TUBES.



CENTRAL STANDPIPE FOR ONE THOUSAND HORSE POWER BOILER.

An Ascension with Tandem Kites.

Lieut. Hugh D. Wise, Ninth Infantry, stationed at Governor's Island, New York Harbor, made an ascension with tandem kites on January 21. This is the first ascension by kites in this country. Lieut. Wise's kite experiments have been referred to before in the columns of the SCIENTIFIC AMERICAN. The lieutenant flew four modified Hargraves kites and had no parachute, so that a fall would, without doubt, have been fatal.

The lieutenant, assisted by Corporal Lewis and five privates, put up early in the afternoon two kites, one with 90 square feet of cotton surface and the other, at the top of the string, with 20 square feet of surface. Two other kites in tandem, the higher one containing 140 and the lower 160 square feet, were flown immediately afterward, and just as the two strings below the lowest kite in the tandems—each string 150 feet long—were about to be fastened together, the spine of the 90 foot kite broke and the kite was torn to bits in the high southeasterly wind. The lieutenant had another 90 foot kite at hand and had it floated in a moment. To hold the four kites the services of four more soldiers were enlisted, making nine men in all.

A half-inch manila cord running from a massive iron windlass, made fast to a tree, was bent on to the kite lines, where they had been joined with the aid of an iron ring. To this ring was made fast a block, through which was rove 100 feet of manila rope, to one end of which a boatswain's chair was swung. The lieutenant got into the chair on what he calls the hoisting line, and two soldiers held the other end of the line, ready to send him aloft when he made the signal. The line on the windlass was let out until the block on the kite strings was about fifty feet above the earth. At that time the wind was blowing about fifteen miles an hour, but it diminished rapidly, and for five minutes the lieutenant was just barely lifted and lowered alternately by the sagging of the lines. At about four o'clock the wind became quite brisk from the southeast and lifted the lieutenant about five feet clear of the ground. He gave the signal to the soldiers to hoist away, and they did so with a will, carrying him up to the block.

The wind died down again at this time, and the line sagged so much that the lieutenant came down to within about twenty feet of the ground. He ordered the soldiers to lower away again, and he came to earth once more. The wind was acquiring a good deal more force, and the lieutenant remained in the chair and again signaled the men to haul on the hoisting rope. This time the kite strings were taut; they sagged only a foot or so even after the lieutenant had been hauled up to the block. He was then forty-two feet from the ground. The oscillation of the swing was slight, and he did not feel uncomfortable. He was a little above the eaves of the officers' quarters near by. He might have gone higher, but he did not think it essential, as he had demonstrated the practicability of his idea.

Lieutenant Wise has some sixty kites of various forms, and he is thoroughly convinced that kites may be put to many practical uses. Their portability and their ability to stand a hard gale which would destroy a balloon are all in their favor. Lieutenant Wise now enjoys the distinction of being the third man to be raised to a considerable distance in the air by kites, the others being Lawrence Hargraves, of Australia, who ascended forty feet, and Captain H. Baden Powell, who ascended one hundred feet in England.

A BICYCLE FRAME REINFORCE.

The illustration represents a means of strengthening bicycle frames, designed to enable them to withstand more severe strains on the parts where the severest stresses come, while the total weight may be lessened. The improvement has been patented by Ferdinand F. Ide, and is being introduced by the F. F. Ide Manufacturing Company, Peoria, Ill. It consists of a novel form of reinforcing sleeves to be fitted snugly on the parts of the frame tubes where the greatest strains come. Each sleeve has on opposite sides elongated

IDE'S BICYCLE FRAME CONSTRUCTION.

tongues, which taper gradually and become thinner toward the points. The tongues and sleeves are brazed to the frame tubes, and are designed to take up the strains transversely or widthwise, thus providing the requisite strength at the desired points. The tubes of which the bicycle frame is constructed, which have heretofore been of uniform thickness throughout, may be made much lighter when this reinforce is applied at the points where the greatest strains come.

Notes on Acetylene.

The following notes on acetylene are extracted from recent technical journals:

Acetylene gas is being experimented with in Paris as a means of lighting omnibuses, says the Progressive Age. The gas generator, weighing about 26 pounds, is placed upon the back platform, under the stairway leading to the top seats. This generator will produce about one cubic meter of gas from one charging; but, as recent photometric measurements make the acetylene gas give about fifteen times more light than ordinary gas, this amount provides sufficient light for one trip. The gas is produced from water and calcium carbide, the generator being so arranged as to furnish the gas in a manner exactly proportioned to the consumption under a pressure of only 5·2 inches of water. The light is sufficiently bright to admit the reading of newspapers, and there is no odor. The new light has been too recently introduced to permit any close estimates as to its actual economy, but the cost is said to be less than that of light from petroleum lamps. The electric accumulators previously tried weighed 275 pounds, and the sulphuric acid solution employed was easily spilled and gave trouble.

Some experiments recently completed by Messrs. Berthelot and Vieille, says the American Gaslight Journal, show that considerable precautions are necessary in dealing with acetylene, particularly in the compressed state. The gas in question is an endothermic body—that is to say, a quantity of heat is liberated on decomposing it into its constituents, hydrogen and carbon. Reasoning on this basis, the experimenters determined to try whether the gas could not be detonated by means of a cap of fulminate of mercury. This proved possible, though at atmospheric pressures the explosive wave did not proceed throughout the body of the gas, the decomposition being limited to the immediate neighborhood of the detonation. When, however, the gas was compressed, the experiments showed that it might prove a dangerous explosive. In fact, it was not then necessary to use a detonator, as it was found that the mere heating of the gas by an incandescent platinum wire was sufficient to cause an explosive decomposition of the acetylene. Average figures from a number of experiments made with different degrees of initial compression showed the following rises of pressure:

Initial Pressure Lb. per sq. in.	Maximum Pressure Observed on Explosion, Lb. per sq. in.	Ratio.
31·7	138·7	4·4
49·4	271·0	5·5
85·1	600·0	7·0
160·0	1,312·0	8·2
301·0	3,028·0	10·1

On opening the steel test tube after an experiment, it was found to be filled with a mass of finely divided carbon agglomerated together by the increase of pressure. The rise of temperature at the moment of explosion was considerable, and in the case of the last of the experiments, referred to above, amounted to as much as 2,750° C. It was, moreover, found possible to detonate liquefied acetylene in the same way, a pressure of over 35 tons per square inch being then attained. The explosion was started, as in the previous cases, by means of a white-hot platinum wire. Dropping a bottle of the liquefied gas, or allowing a heavy object to fall on it, proved insufficient to detonate the mixture, although when the bottle was broken by the weight a violent explosion occurred. This, however, arose from the combustion of the gas, and thus differed materially in nature from the experiments previously made, in which the acetylene was merely resolved into its elements.

Devices of Prisoners for Communication With Each Other.

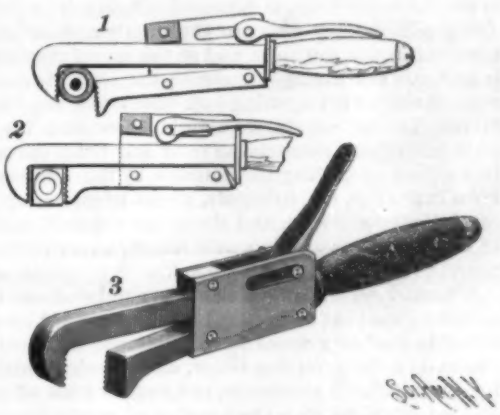
Some of the ingenious tricks resorted to by the inmates of jails and reformatories to hold communication, contrary to the rules, with their fellow prisoners are thus described in an article on prison life in The Hospital (November 14):

"The prisoners . . . make every conceivable effort to hold intercourse of some kind with their fellow culprits, if only to relieve the silence and solitude—intolerable to persons of their class, who have not sufficient cultivation of mind to supply them with food for thought. . . . Knocking on the walls of separation between the cells, scratching sentences on the sides of the baths or the bottom of the tins used to contain their gruel, and many other devices of that inadequate nature, are instantly detected and stopped by the officials. The chapel is perhaps the most favorable ground for enabling them to let their presence at least be known to acquaintances who have been incarcerated at an earlier or later period from themselves. The male and female prisoners are, of course, rigidly separated during the services. A high and strong wooden partition divides the portion of the building they respectively occupy, but they do not allow this serious obstacle to deter them altogether from the communications they specially desire to hold with the opposite sex. In singing the hymns they often try to introduce words of their own, or make very peculiar responses, which can be understood over the wall. A male prisoner will be afflicted with an extremely bad cough, which, in measured attacks, makes known to a lady friend on the other side that he is 'in quod;' but he is seldom oppressed by this bronchial malady on more than one occasion, since the governor informs him that, as his cough is so distressing, he is to remain in his cell and not be exposed to the air of the chapel until he is better—a cure for his complaint which is at once perfectly complete. On the female side of the partition a woman permitted to take her infant, born in prison, to chapel with her, pinches the unfortunate mite till its shrill yells reveal her proximity to its father attentively listening through the wall.

"Recently the governor of one of our county prisons was greatly perplexed by the discovery that the female criminals in his charge managed in some mysterious manner to ascertain the presence of every individual man on the other side of the impervious dividing barrier. One of the women inadvertently let drop the fact that she had recognized her husband, whose position there must, according to rule, have been completely unknown to her. None of the officers could account for an unpermitted knowledge which was found to be shared by all the other women. At last a very careful examination of the chapel gave an explanation of the mystery. Although strictly divided, as we have said, both the male and female prisoners faced the altar in their seats, and over it had been fixed a very large brass cross against the wall, so highly polished as to form a very good mirror. In its clear surface the women saw the reflection of every man as he passed to his place, and had enjoyed the spectacle with impunity, till a wife, much interested in the appearance of her spouse, had made an imprudent remark to one of the officers, which revealed the fact. The brass cross instantaneously disappeared, and the blank wall behind it no longer tells any secrets."—The Literary Digest.

A NOVEL WRENCH.

The tool shown in the engraving is adapted for use either as a pipe wrench or a monkey wrench, and has a novel and convenient adjustment for the movable jaw. It forms the subject of a patent recently issued to Murat K. Flye, of Sharpsburg, Texas. In Fig. 1 it is shown in use as a pipe wrench and in Fig. 2 as a monkey wrench; Fig. 3 representing the improvement in perspective. The shank of the movable jaw is connected to the main shank by a yoke whose side plates have longitudinal slots in which is movable a cam lever, and when the latter is at the rear end of the slots, the wrench is especially efficient as a pipe wrench, the yoke then having a rocking movement, which is facilitated by the beveled rear end of the movable shank. The parts are in the position shown in Fig. 3 when the wrench is to be adjusted to a pipe, the throwing down of the cam lever then bringing the jaws into

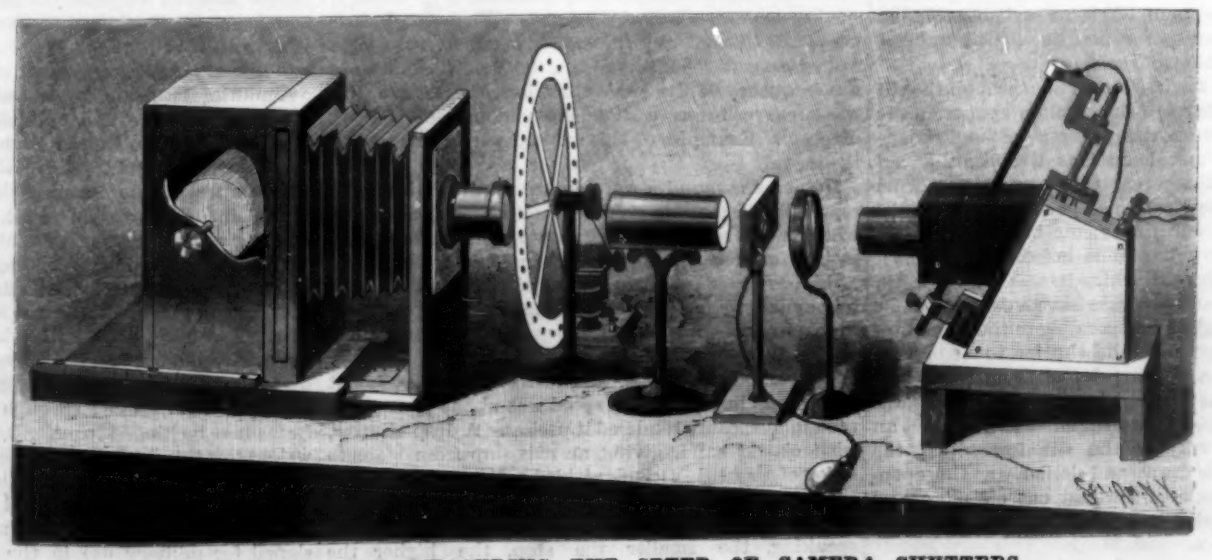


FLYE'S IMPROVED WRENCH.

closer engagement. With the cam lever shifted to the forward end of the slots, as shown in Fig. 2, the sliding shank is brought close to the main shank, and, after adjusting the wrench to a nut, the lever is thrown down, clamping the movable jaw in place, with both jaws at right angles to the body of the wrench.

METHOD OF MEASURING THE SPEED OF CAMERA SHUTTERS.

Captain W. de W. Abney explained before the Camera Club, of London, a short time ago, his method of measuring the speed of photographic camera shutters, which has special advantages as regards accuracy and facility of record, brought about in a somewhat novel manner. In a report of his lecture, which we extract from the London Amateur Photographer, are several interesting facts. The lecturer pointed out that it was quite as important to know whether we were giving an exposure of say $\frac{1}{5}$ or $\frac{1}{10}$ of a second as one of 5 or 15 seconds. The apparatus enables us not only to measure the time of exposure, but also causes any kind of shutter to draw its own diagram, and from this diagram several things are made known, e. g., how long it took to open, and to close, and how long the working aperture of the lens was fully open, etc.—



APPARATUS FOR MEASURING THE SPEED OF CAMERA SHUTTERS.

three points of very great practical importance. The apparatus employed is somewhat as follows:

A source of light; in this case the electric arc, but magnesium can be used: the essentials being a steady and strong actinic light.

A supplementary positive lens. This is so placed that it throws an image of the carbon points upon the lens in the front of the camera.

The electric arc lamp will be noticed at the right hand of the end of the engraving, which projects a beam of light upon the condensing lens supported on a stand, and this in turn concentrates the beam upon the shutter to be tested, which is held in an upright stand next to its left. The actuating bulb of the shutter will be seen upon the table. Different makes of shutters can be held by this stand. The stand next on the left supports a spectroscope tube without any lens, having the slit two inches long by $\frac{1}{10}$ of an inch wide, in a horizontal position. A cardboard with a slit cut in it, inserted in the tube, answers as well as the regular slit. The condensing lens is adjusted with reference to the light so as to fully cover the whole of the horizontal slit. The motion of the shutter is in the direction of the length of the slit in the card.

At the left of the spectroscope stand is a rotating circular cardboard disk divided into six sector openings divided only by a narrow radial bar. The apparatus reminds one of a wheel with only six spokes. Along the rim are punched out a series of small holes, equidistant. Six of these holes correspond to each sector opening, so that there are thirty-six holes in all. The apparatus is made to revolve (about its center) in a vertical plane just in front of the lens of the camera, and as each spoke of the wheel passes in front of the lens, and is parallel to the slit in the tube, it intercepts the light. The wheel is made to revolve at a uniform speed by a small electro-motor which will be seen to the left of it. It is important to know the wheel's rate of revolution. This may be done in two ways. First, by blowing air through a small tube perpendicular to the plane of the sector, and just opposite the row of the thirty-six holes, it becomes (effectively) a siren. The pitch of the note gives the number of air puffs passing through the holes, and so the rate of revolution is known. For example, suppose the air puffs gave a note agreeing with a tuning fork which was known to vibrate 720 per second, we should know that 720 air puffs had passed through the tube and holes opposite in a second. Dividing this number by the number of holes in the rim, viz., thirty-six, we get twenty complete revolutions per second, and since there are six spokes in the wheel, one spoke would follow its neighbor in front of the lens in $\frac{1}{120}$ of a second.

A second method, and the one employed on this occasion, was that of pressing into our service an old turnstile counting apparatus. This was attached to the axis of the revolving sector, and its index watched for a set time, say 10 seconds, the number read off and divided by 10 to give the number of revolutions per second.

Behind the sector wheel is seen the lens and camera arranged in the same plane with the other parts of the apparatus, having a special chamber in the rear, holding a metal drum five inches in diameter, extending transversely across the interior of the camera to its full width. The drum turns about a horizontal axis that is parallel to the slit in the spectroscope tube and perpendicular to the optic axis of the line of the apparatus. One end of the axis projecting through the side of the camera has a pulley disk on the end. The cylinder may be seen through the broken portion of the camera. The camera lens is adjusted to throw a sharp image of the slit in the spectroscope, upon the center of the surface of the cylinder in the camera. The cylinder is covered with a strip of sensitive (e. g., bromide) paper held in position by elastic bands.

In place of the cylinder of bromide paper a circular sensitized glass plate can be fixed in a vertical plane in the back of the camera and made to rotate or whirl at a given speed, the flashes of light through the slit impressing it in the shape of radial lines, their number determining the rapidity of the shutter.

If now light from the lantern passes through the slit lens, etc., on to the front of the revolving paper on the drum, it would trace on the paper a rectangle image of the same width and length as the slit, the vertical length depending upon the rate of the drum revolutions, i. e., how much paper turned past the image of the slit. If the sector be set revolving, every time a spoke or bar came in front of the lens it would cut off the light while it was passing. On developing the paper we should have a dark rectangle crossed by bars of light corresponding to the transits of the spokes. Suppose now the shutter to be of that form which causes a rectangular opening to pass in front of the lens. As the beginning of the opening was commencing to travel across the slit we should get an image of a portion only of the slit formed on the front of the revolving drum, and similarly as the opening commenced to close it would cut off more and more light from the slit, and so on, the image dwindling from a line to a point.

In Fig. 3 we have some such result. If we suppose the drum and sector to be stationary, we should get an image of the slit as a straight line as H_1H_2. If the drum revolved and the sector was stationary, this straight line would be drawn out into a rectangle. If the sectors revolved, we should find this interspaced with clear parts, but suppose the shutter to commence slowly opening at the end H_1, and go on until the whole slit H_1H_2 were fully covered by light for a time and then begin to close up again from H_1 toward H_2, the sector and drum revolving at the time, we should have some such figure as N M K L. The triangular part, M M′ N, corresponding to the time the shutter took to get fully open, the rectangular part, M M′ L L′, being the time that it remained fully open, and the triangular part, L L′ K, the period of closing. On further examining this diagram we note two complete bar spaces, and a little portion outside each, together equal to about that between two clear spaces. If now the sector were revolving at the rate above supposed and described, i. e., $\frac{1}{120}$ second between each bar space, we should say that the shutter took then something between two and three such intervals to open, say, $\frac{1}{30}$ to $\frac{1}{25}$ second to get fully open; remained fully open about two spaces, i. e., say, $\frac{1}{30}$, and closed in a little more than one space, $\frac{1}{120}$ to $\frac{1}{150}$ second. The ideal or theoretical perfect shutter is one which takes no time to become fully open and to close as quickly, but as this is as yet not a practical thing, we have to accept this as a mental conception, and compare the actual performance of any shutter with it by contrasting its practical efficiency with its theoretically possible efficiency; we thus need but compare the area, M M′ L L′, i. e., the period of full opening, with the corresponding area, N N′ K K′, i. e., the base, N K′, with base, L M′.

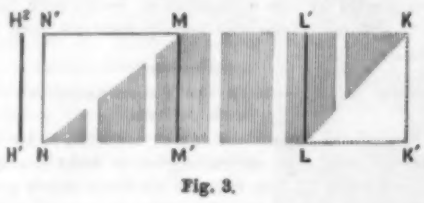


Fig. 3.

In Fig. 4 we have two other diagrams yielded by shutters opening and closing at the center. The areas inclosed by the dotted lines correspond to the ideal unit of efficiency. We can see at a glance that the A shutter is much more efficient than the other, i. e., B form, which latter takes quite a comparatively long time to open as compared with the time it is fully open, but closes quicker than it opens. Examination of many shutters has led the lecturer to the conclusion that very few of them had more than about 65 per cent efficiency.

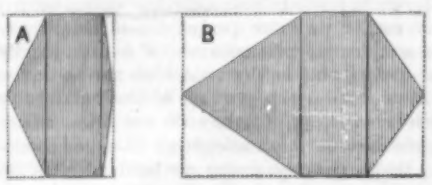


Fig. 4.

When working the apparatus as above described, when the speed of the sectors and bars was a knowable quantity, there was no necessity to measure the speed of the revolving drum. All that was required was a fairly steady motion, and that it be fast enough. This the lecturer easily attained for the demonstrated experiments by revolving the projecting axis by means of the fingers or a piece of string in the same way that one may cause a top to spin. If, however, the measuring of the speed of the sectors be a difficulty or objection, the following device may be substituted: a vibrating (tuning) fork of known frequency has attached to one of its arms a small reflecting mirror, which throws an independent point of light through the lens on to the face of the drum. When the fork is made to vibrate and the drum to revolve, the light from the small reflector traces a wave curve, and since the frequency of the fork's vibrations are known, this wave curve forms a time scale alongside the slit diagram. Examples of this method were shown upon the screen.

Numerous examples were shown and explained, one especially demanding mention being that of a shutter which, when set at a rather slow speed, gave a fairly satisfactory record of its performances, but when set at a higher speed clearly betrayed the fact that it rebounded to such an extent that a slight secondary exposure was made. Under such circumstances obviously it would not be likely to yield satisfactory negatives. This shutter acted satisfactorily at about $\frac{1}{25}$ second, but when its speed was about $\frac{1}{50}$ or $\frac{1}{75}$ the rebound exposure rendered it useless. A drop shutter, with elastic band, giving an exposure from start to finish of about $\frac{1}{150}$ second, yielded a diagram similar in shape to that in Fig. 3, but the time during which it was fully open was only about $\frac{1}{250}$ second. Generally speaking, the smaller the stop, the higher the efficiency.

Bicycle Notes.

Verdi is trying to eclipse Cato's feat of learning Greek at eighty by riding a bicycle at eighty-two.

Of 28,000 applications for patents in England so far this year, more than one-third are for improvements in bicycles.

It is reported, says Uhland's Wochenschrift, that the pneumatic tires for the bicycles used in the French army are now to be made of leather.

The average pedestrian moves about thirty inches at each step. The wheelman mounted on a bicycle of average gear covers about 8½ feet at each downward movement of the legs, which makes half a revolution of the pedals.

The city of Kobe, Japan, has issued a set of regulations governing the use of bicycles in its streets. They are much the same as those adopted in this country, except that riding for pleasure is prohibited after dark. One may ride on business, provided he goes slowly and carries a lantern.

Ripley Church, southwest of London, is being turned into a sort of bicyclists' Westminster Abbey. It has now a memorial window to H. L. Cortis, who held a number of records a dozen years ago, and another window put up by cyclists to the memory of the hostesses of the Ripley Inn.

Lady bicyclists have begun to utilize their discarded bicycles for ornamental purposes. When a bicycle has had its day it is dismembered, limb from limb, and the parts hung up on the drawing room wall. On nails that once supported china brackets, over doors where fans held position, all the remains of the old cycles are displayed to view.

A foolhardy feat has been performed by a young cyclist at Atlanta, Ga. He rode a bicycle down an inclined board platform two feet wide from the top of a high building into the waters of the adjacent lake. Four men held the machine while he mounted, and at the word "go," he was sent off, and in an instant shot into the water, going over the handlebars of his machine. Both rider and bicycle were fished out in good condition.

The most stupid anti-cyclist law, and there have been many of them, says the American Wheelman, is reported from Austria, where, in the district of Neustadt, the gendarmes have been arresting all cyclists riding in daytime without lanterns. The cyclists of Vienna, the most progressive wheelmen in the empire, where the sport is not yet free from many vexatious restrictions, fomented the most active resistance to the law. A leading journal of the city called on the 20,000 riders of the captial to visit Neustadt en masse and, by compelling thousands of arrests, to show the stupidity of the law.

Chainless bicycles, in which two pairs of bevel gears are used instead of the chain, are reported to have proved their superiority over the present style of wheel in a test, in which a wheel was run thirty-nine thousand miles without adjustment or appreciable wear, says Engineering News. "Dynamometer tests also show that the bevel gears run with less friction than the chain. It is stated that one of the largest manufacturers will soon put these wheels on the market. An obstacle to their rapid introduction is the time required to construct the machinery necessary for turning out the bevel wheels, which must be mathematically accurate in form."

A duel on bicycles was fought in the Boulevard Ney, Paris, recently, says the Westminster Gazette. A large party of young fellows had been out cycling all day and were returning home, all very hilarious, when two of them quarreled, and they decided to settle the dispute by a duel with swords on their bicycles. The two combatants were placed fifty yards apart and then ordered to charge. They rode at one another at a furious pace, but overshot the mark and failed to meet. Wheeling quickly round, they returned to the charge, and this time came together with a terrific shock. Both were thrown, while the seconds, who were following behind also on bicycles, fell in their turn, and both were injured. Neither of the combatants touched the other with his sword, but, in falling, one ran his weapon into himself, and his opponent injured his leg.

A military tandem bicycle has been designed by an officer of our army and is illustrated and described in the Journal of the United States Artillery for November-December, by Lieut. William C. Davis, U.S.A. The feature of the device is the absence of sprocket and chain. The two riders sit directly over the front and rear wheels respectively, and the crank axles are geared up to the proper speed by a suitable mechanism in a gear box on the axle. This is a simple epicycle gear, giving two revolutions of the wheel to one of the axle. The front or steering wheel is analogous to the "geared ordinary," and the two wheels are connected by a Humber frame. The gearing is in a dustproof gear box, and is oiled through the hollow axle; the frame may be hinged to make it more portable, and the weight of this bicycle need not exceed 40 pounds for the roughest service. It is designed to carry two riders and 40 pounds additional weight of equipment. The same article describes a number of bicycles designed for military use in the French and German armies, but all of these have chains.

Recent Archæological News.

It is said that an unknown ruined city of large area, with two temples and two pyramids, has been discovered in the state of Gurrero, Mexico, by Mr. William Niven, a well known mineralogist.

Gross vandalism has destroyed some interesting Druidical remains on Dartmoor. The stone avenue at Bel Tor corner on Sherburton Common and many "hut circles" and "menshirs" have disappeared. The stones have been broken up by contractors to furnish material in mending adjacent roads.

In one of the chief squares of Patras some important sculpture and an ancient mosaic pavement have recently been discovered. The most important piece is a statuette which is undoubtedly a copy of the Athene Parthenos of Phidias. The head and arms and part of the shield are missing, but it is hoped they may be found on further excavation.

A heathen burying ground, with giant skeletons, was recently dug up at Mitterndorf, in the Austrian Salzkammergut. Many of the bodies were six feet seven inches tall; they were all buried with the feet to the east, each inclosed in a circle of stones, with a stone under the head. Large earrings and finger rings were found on them, and one skeleton held a knife in its hand. No signs of Christian burial were discovered.

A new "Survey of London" is being prepared, under the editorship of Sir Walter Besant, which will give an account of every important building, institution, and company in the whole of Greater London. It will contain a history of the city, its trade, political power, and customs, and will be a complete record of its condition at the end of the nineteenth century. The book will be in eight quarto volumes, fully illustrated, and will be published by the Blacks.

Cornell University, which for some years has had the finest archæological museum of any American university, has just added to it a collection of rare specimens of ancient Greek pottery, showing the development of the art from the beginnings about 1500 B. C. to its perfection about 450 B. C. These were purchased for the university by Prof. B. I. Wheeler while in charge of the American School at Athens last year. A collection of ancient Greek coins, bought from the same appropriation, has not yet been catalogued.

The London Society for the Protection of Ancient Buildings has written to Lord Cromer concerning the defacement of Nile scenery in consequence of the blasting operations now being carried on for the purpose of obtaining limestone for the embanking of the river. The petitioners point out that although stone has always been obtained from the cliffs of the Nile, yet the ancients never procured it in the present wasteful manner, and suggest that certain spots should be selected to take the stone from, and that in future the quarries should be driven into the rock, instead of prominences being blown away.

At a recent sitting of the Academy of Inscriptions, a letter was read from M. Gaukler, Director of Antiquities in Tunis, reporting the discovery at Susa of a well preserved mosaic, the central figure in which is believed to be Virgil. Dressed in a white toga with blue border, he has on his knees an open papyrus containing the eighth line of the first book of the Æneid. The Muse of History and the Muse of Tragedy, standing on each side, are listening. The central figure, beardless and with short hair, agrees with ancient miniatures of Virgil, the only portraits hitherto known. The mosaic is thought to be a contemporary copy of some celebrated work, perhaps of one of the vignettes mentioned by Martial. The Academy showed great interest in this discovery.

The Norwegian traveler, Sven Hedin, has contributed to a German journal, Globus, an interesting account of his journeyings in Central Asia, in the district north of the Kwenlung Mountains. Ruins of large towns were discovered which have been buried by successive sandstorms spreading over a thousand years; hence very modern from a Petrie point of view. Separate houses were uncovered of very fragile construction, consisting of wooden pillars, while the walls were put together of plaited reeds covered with mud. The latter were rendered at once impervious and suitable for decoration by being coated with white plaster. Drawings were discovered on these walls, and well executed, of human figures, horses, dogs and flowers, and, judging by the copies which have been brought back, of no small artistic merit. Small figures of Buddha were also dug up, as well as various fruit trees, which told a tale of the bygone days when this arid surface was once made fertile by the waters of the river Kerija.

Dr. Dörpfeld, in one of his recent lectures in this country, expressed the opinion that the latest archæological explorations in Greece, richly rewarded as they have been, instead of exhausting the field, have, as yet, barely made a beginning in the work of bringing to light what Greece has to offer in the way of archæological information, says the American Architect. So far as the classical period of Greece is concerned, Delphi, Olympia, and the cities of Asia Minor have still much to show, but the greatest discoveries are probably to be made in the ruins of the prehistoric period, at Mycenæ, Argos, Medea, Orchomenos, and other places. The remains of ancient Argos, which, according to the legend, was built by seven one-eyed giants from Asia, have hardly been touched, and, after the discovery of the body of Agamemnon amid the ashes of his palace at Mycenæ, it would be hard to say that the bones of Jason, if not, indeed, the talking prow of the Argo, may not be exhumed in the more ancient city, which, even in historical times, showed the tomb of Ariadne. It seems to be settled that the inhabitants of Argolis at the Homeric period were ignorant of the use of writing, thus confirming the ancient tradition, that the poems of Homer were not written, but handed down by verbal repetition for many generations before they were committed to writing; and everything that can be learned about the people who have for three thousand years been regarded as demigods and heroes is doubly interesting, not only as an addition to the legends which have made Jason and Medea, Orpheus, Æsculapius, Theseus, Castor and Pollux, Admetus and Atalanta, and the other Argonauts, nearly as familiar to us as they were to the Roman youths two thousand years ago, and to the Greeks a thousand years earlier still, but as a contribution to the early history of the human race.

A VEHICLE RUNNING GEAR ATTACHMENT.

To facilitate the making of short turns with a vehicle is the object of the improvement shown in the accompanying illustration, according to which two small wheels or casters arranged beneath an axle may be made to engage the ground and lift the main wheels, so that the distance between the wheels supporting the axle will be diminished. The improvement has been patented by Archie D. Blodgett, of Berlin, N. H. Clamped to the rear axle are clips with bearing plates in which are held two horizontal shafts, each carrying

BLODGETT'S VEHICLE RUNNING GEAR.

at one end a vertical shaft and at the other end a downwardly extending brace, the lower ends of the braces having bearings for the lower ends of the vertical shafts, and each of the latter carrying a caster wheel, as shown in Fig. 1. Springs connected with the vertical shaft tend to keep the axes of the casters transverse to the reach and springs on the horizontal shafts tend to throw the vertical shafts rearward and upward, away from the ground. Rigidly held on the under side of the reach is a guide plate, on each edge of which is a slide co-operating with an arm carried by a thumbscrew in the sides of the reach, the arms swinging to allow the slides to move freely or hold them at the limit of their movement. Projecting downward from each slide is an arm, and both arms are connected by rods with the bearings of the shafts near the casters, the arms being adapted to be locked, to be moved in unison, and being also connected by chains to each side of the front axle. The arrangement is such that, as the vehicle turns to the right, the left hand chain will be drawn on, moving the left hand slide, and swinging the corresponding vertical shaft downward, when its caster engages the ground and lifts the left hand main wheel. When it is desired to have both the casters engage the ground, the slides are connected with each other by a locking bolt, when both casters will engage the ground as the vehicle turns in either direction. Fig. 2 represents a modification of the improvement in which the use of the spiral springs is avoided, and spring arms carried by the rear axle are employed, the modification being more especially adapted to vehicles in which it is inconvenient or undesirable to attach the rods to the reach.

DOMESTIC fowls have two diseases of a diphtheritic nature, according to a report of M. Gallez to the Belgian Academy of Medicine. One is a contagious catarrh, called also morve, or fowl glanders, which is very contagious and fatal to hens and may give diphtheria to human beings. The other, though called fowl diphtheria, has nothing save the name in common with human diphtheria.

Science Notes.

Prof. Fresenius disclaims any confirmation of M. Barrière's alleged discovery of a new element, "lucium."

The tercentenary of the birth of Descartes was celebrated at Tours, recently, by the local archæological society.

The collection of fossils made by the late Prof. Sir Joseph Prestwich has been presented to the Geological Department of the British Museum by Lady Prestwich.

Dr. Roux has accepted a decoration from the German Emperor. Pasteur declined a similar honor, but the conditions were slightly altered in the present case, and Dr. Roux very properly did not decline the honor.

A magnificent daylight meteor was seen by Prof. Brooks at the Smith Observatory, Geneva, New York, on the afternoon of January 19, soon after sunset. It exceeded Venus in brilliancy and moved slowly southward across the eastern sky.

By thermo-electric methods Messrs. Holman, Lawrence, and Barr have recently fixed the melting points of the following metals: Copper melts at 1,095° Cent., silver melts at 970° Cent., platinum melts at 1,759° Cent., and aluminum melts at 660° Cent.

M. Levat has recently made a communication to the Paris Academy of Sciences on the tempering of steel in phenol. From comparative trials on the same steels tempered in water and phenol respectively, it has been found that the hardness and elasticity in the latter case was much greater than in the former.

In mediæval times rhinoceros horns were employed for drinking cups by royal personages, the notion being that poison put into them would show itself by bubbling. There may have been some truth in the idea, as many of the ancient poisons were acids, and they would decompose the horny material very quickly.

A bill to promote aerial navigation has been introduced by Representative Baker, of New Hampshire. It is proposed to give $30,000 to Prof. Langley, $20,000 to James Selden Cowden, of Virginia, and $20,000 to the War Department. There is little chance of such a bill being passed, and it is a question if public money should be used for such a purpose.

M. Gaston Tissandier, who, for the last quarter of a century, has presided over La Nature, our excellent French contemporary, has just retired from the editorship and M. Henri de Parville has succeeded him. The character of this model scientific journal will not be changed, and it is to be hoped that the high degree of success which has attended this journal in the past will continue to be enjoyed by it.

Krafft-Ebing, of the University of Vienna, according to the Medical Times, New York, enlivened his instruction lately by allowing a madman, one of his patients, to lecture on mental diseases in his stead. The man is afflicted by periodic attacks of mania, during which he is much more clever and witty than when sane. His lecture on "The Mental Condition of the Maniac in Periodical Attacks of Madness" was a brilliant success. After it was over he was shut up again.

The hot lakes district of New Zealand, covering an area of 1,000 square miles, is very actively and peculiarly volcanic. The particular attraction of the district lies in the changes that are continually taking place in it. Almost from day to day extraordinary transformations are worked by heat, fire and steam. The greatest of the volcanic mountains, Ruapehu, rises to a height of 9,000 feet, and one of the geysers is estimated to throw water and steam to a height of 180 feet, while the lakes, ponds and pools contain water of every degree of temperature.

The toxicity of the flesh of poisoned animals may easily prove a source of danger, and at a recent meeting of the Medical Society of Berlin, Lewin recounted some interesting experiments made to determine the toxicity of such flesh. Having given 20 centigrammes of strychnine to a fowl, he gave its flesh to a dog to eat. After the first 225 grammes the animal became ill; after a second portion it was seized with tetanic convulsions and died. The experimenter found that some animals are very tolerant of certain poisons, for example, fowls to strychnine, goats to hemlock, partridges to arsenic, rabbits to nicotine. He considers, says the Pharmaceutical Journal, that although animals may have ingested poisons without inconvenience to themselves, it may easily follow that their flesh will prove toxic to man if used as food.

Wm. Crookes, F.R.S., of thallium and radiometer fame, in lecturing on "Diamonds," at the Imperial Institute, says Knowledge, disclosed some interesting facts. He mentioned that the four principal mines (Kimberley) employed about eight thousand persons. From two to three million carats of diamonds were turned out in a year, and up to the end of 1892 ten tons of diamonds, valued at £60,000,000, had come from those mines. In 1895 there were found 2,435,541 carats of diamonds, realizing £3,105,958, at an expenditure of £1,704,813, and leaving a profit of £1,401,145. The largest known diamond, weighing 970 carats, was found at Jagersfontein mine, and was now being cut at Amsterdam. But even diamond mining has limitations, for Mr. Crookes said the mines were capable of yielding more, but they were limited to a certain output in order to maintain the price.

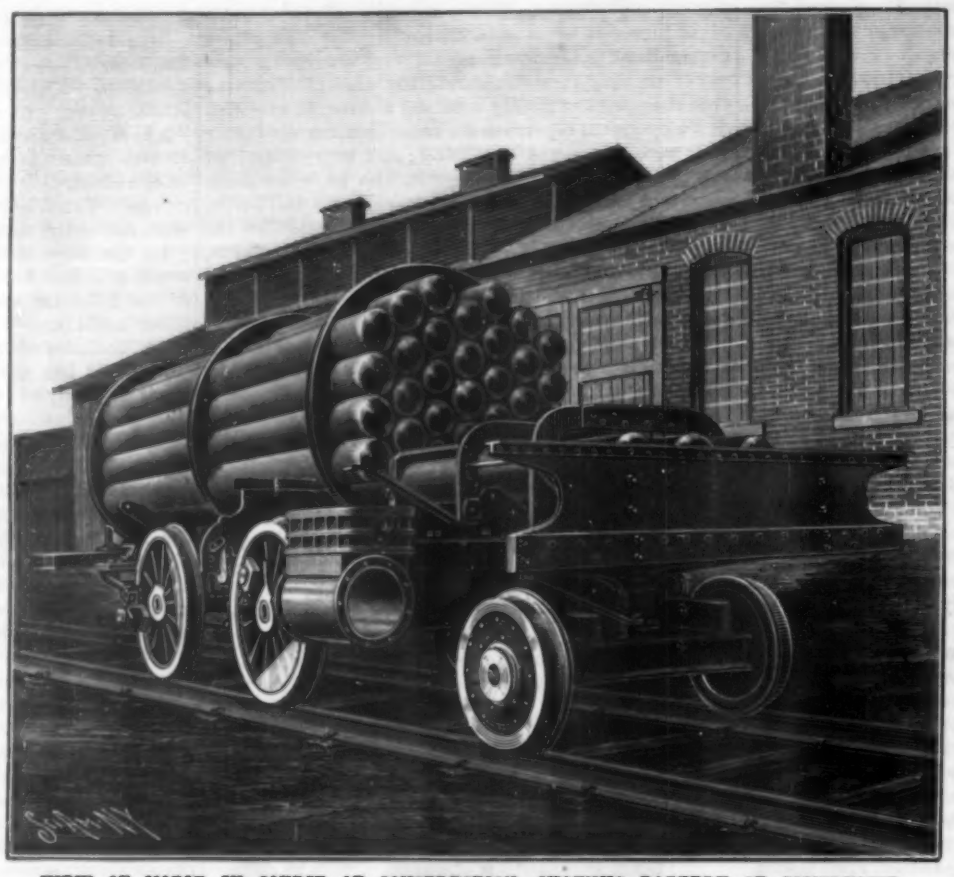
COMPRESSED AIR MOTOR ON THE ELEVATED RAILROADS, NEW YORK.

Compressed air, considered as a motive power, affords a striking evidence of the pertinacity with which a prejudice, which has been engendered by early failures in any line of experimentation, will cling to it in subsequent attempts. At least so it would seem, if one should judge by the ever recurring predictions of failure which greet the arrival of a new design of compressed air motor. These predictions are usually prefaced with the statement that the defects of compressed air are inherent in the application of the principles upon which it works, certain physical laws rendering it impossible that a high efficiency can be achieved.

That the early attempts were doomed to failure because of an extravagant loss of power between the compressor and the motor cannot be denied; but that the defect should be set down as permanent and without remedy is to cast discredit upon the resources of science and mechanics. So far from the course of invention in this particular field being of the blind and uninstructed kind, it has been carried out on scientific lines and marked by an intelligent investigation which will compare favorably with that in any other field of experiment.

In the early and faulty use of the system, air was compressed and stored in a receiver, from which it was drawn for use in the cylinders of the motor. It was found that the mean pressure available behind the piston of the motor was very much less than the mean pressure at the air piston of the compressor. So great was the loss that in some of the plants it is acknowledged to have amounted to between fifty and sixty per cent. The difficulty was due to a natural law governing the contraction and expansion of air, according to which its sudden compression is marked by a sudden rise in temperature, and its sudden expansion being followed by a corresponding fall. If a given volume of free air be compressed to one-half, its temperature will be raised 116 degrees; on the other hand, if a given volume of free air be expanded to twice its original volume, its temperature will fall 116 degrees. If air be compressed in unjacketed cylinders, the attendant heat will be communicated to the walls of the cylinders and lost by radiation, and what heat is not lost in this way will escape by radiation from the storage tanks, as its temperature falls to that of the surrounding atmosphere. Again, the expansion of the air in the motor cylinders will be attended with a corresponding fall of temperature, which, according to law, will be accompanied by a decrease in volume and, therefore, in pressure, this decrease in pressure being additional to that which results from the expansion of the air due to the travel of the piston. There will thus be a loss at both ends—that at the compressor due to the generation of heat and that at the motor due to its dissipation. There will also be the mechanical disadvantage that, the temperature of the exhaust being considerably below the freezing point, the passages are liable to be clogged with ice.

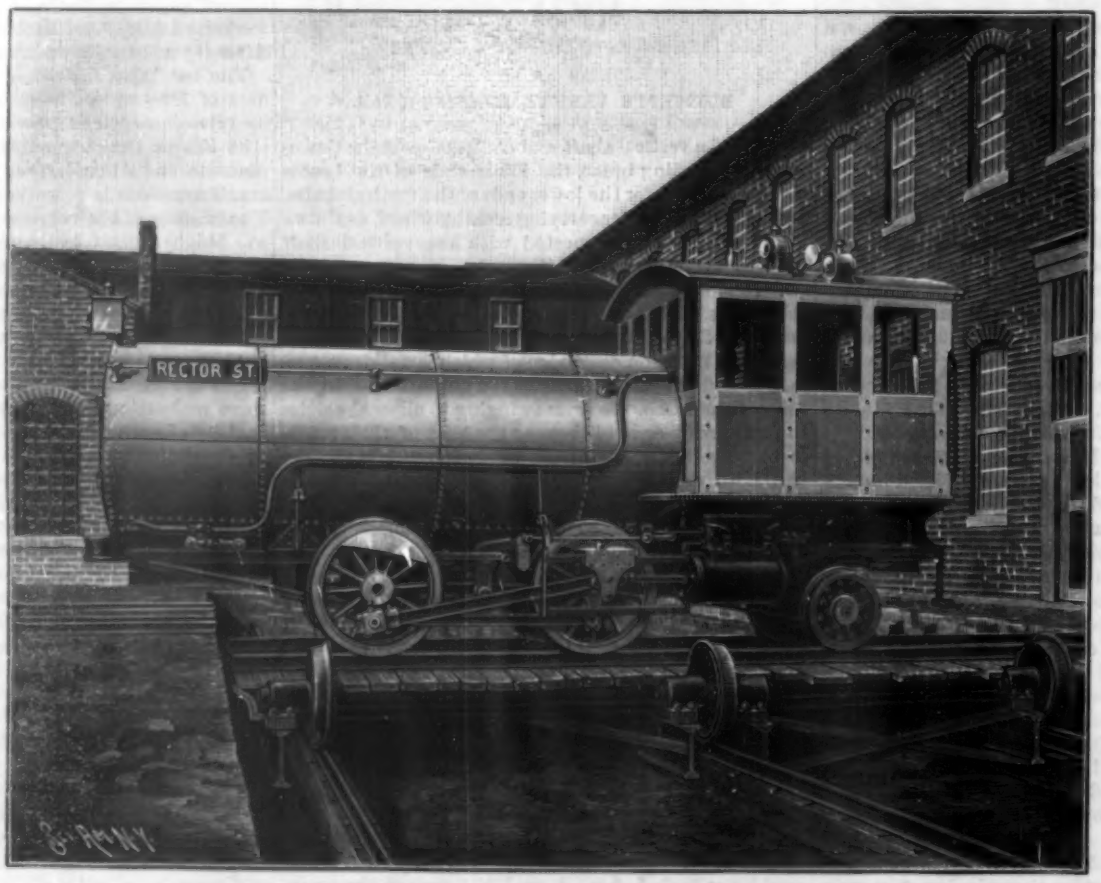
These are the fundamental difficulties which threw discredit upon the first attempts to use compressed air as a motive power, and led to the sweeping assertion that it was inherently and essentially uneconomical. Subsequent experiments in Europe and America have shown, however, that by the application of heat to the air on its way from compressor to motor, its efficiency may be largely increased, and in the various street car motors now running in both countries this reheating is invariably carried out. The system adopted by the builders of the motor which forms the subject of the accompanying illustrations consists in passing the compressed air through a tank of hot water before it is used in the cylinders. There are certain other economies attending the compression at the power station and the utilization of the exhaust steam which altogether render the plant of the Hardie motor of special scientific and technical interest. One of the most marked advances over the old systems is seen in the extremely high pressure (2,000 pounds to the square inch) at which the air is stored in the tanks. This has been adopted because of the valuable and opportune property of air that under high pressures a certain increase of pressure calls for less power and produces less heat than under low pressures. It has been found that to compress 1 cubic foot of free air to 500 pounds pressure per minute requires 0·316 horse power, whereas to compress the same amount of free air to 2,000 pounds pressure requires only 0·400 horse power, though it is deemed advisable to allow 0·45 horse power in practice. The heat of compression is saved by compressing the air in three stages, and passing the heated air through tubes around which cold water is circulating. The air-cooling water is fed to the boilers, and the heat which it has withdrawn from the compressed air is thus recovered. The compressed air is stored in a nest of rolled steel flasks at the normal temperature of the atmosphere, and from them is supplied to a similar nest of flasks carried on the motor.



VIEW OF MOTOR IN COURSE OF CONSTRUCTION, SHOWING BATTERY OF COMPRESSED AIR STORAGE FLASKS.

The reheating of the air is accomplished by passing it at the working pressure of 150 pounds to the square inch—to which it is brought down by a reducing valve—through a tank of water heated to 350 degrees, which is carried on the motor and recharged at the end of each trip. In its passage through the hot water, the air is not only expanded by the increase of temperature by fifty per cent of its original volume, but it absorbs and carries over to the cylinders an amount of water, in the shape of steam, equivalent to half its own original volume. Thus each fifty cubic feet of air admitted from the storage flasks takes up half its own volume of steam, or twenty-six cubic feet—an increase of over fifty per cent; and as it also receives an increase of volume of fifty per cent due to increase of temperature, there is a total gain of volume, as the air and steam pass from the heater, of 100 per cent. The condensation of the steam in the cylinders and pipes liberates the latent heat and maintains the temperature well above the freezing point, besides acting as a lubricant in the cylinders.

The experimental motor which will shortly be running on the elevated roads differs materially in appearance from the steam locomotives now employed. The boiler of the latter will be replaced by a stack of 36 tanks or flasks, 9 inches diameter by 15½ feet long, inclosed in a sheet iron casing. The familiar steam dome and smokestack are wanting; the sand box being placed as at present below on the frame There are four coupled driving wheels, and the cylinders, which are 13½ inches in diameter by 20 inches stroke, are placed directly beneath the cab. These, it will be seen, are considerably larger than those of the present locomotives, which are 12 inches diameter by 16 inches stroke. Altogether the new motor will be a much more powerful machine.



COMPRESSED AIR MOTOR FOR THE ELEVATED RAILROADS NEW YORK CITY.

On a line with such frequent stops as the elevated road, rapidity in starting is a consideration of the first importance. In addition to its increased cylinder power, the motor is provided with a by-pass, by which air may be admitted to the cylinders independently of the slide valve. The motor is thus provided with a reserve of tractive effort which will save several seconds each time the train is started and will result in a saving of several minutes on the round trip.

From the above description our readers will be able to secure a general idea of the principles and construc-

tion of the new motor, which is about to contest the supremacy of the steam locomotive under conditions which will provide "a fair field and no favor." Judging from the results obtained with the Hardie motors which are running on the lines of the Third Avenue company in this city, it is reasonable to expect that the new motor will not suffer in the comparison. The first two of these cars, which were put in service on August 3, 1896, have now run about 20,000 miles and carried 125,000 passengers. During the heaviest snow storm of this winter they ran 153 miles on time, their service comparing favorably with that of the cable cars.

How far the same efficiency can be shown by the heavier motors, and how far they can show superior economy to the steam locomotive, will now be determined by a lengthy and careful test.

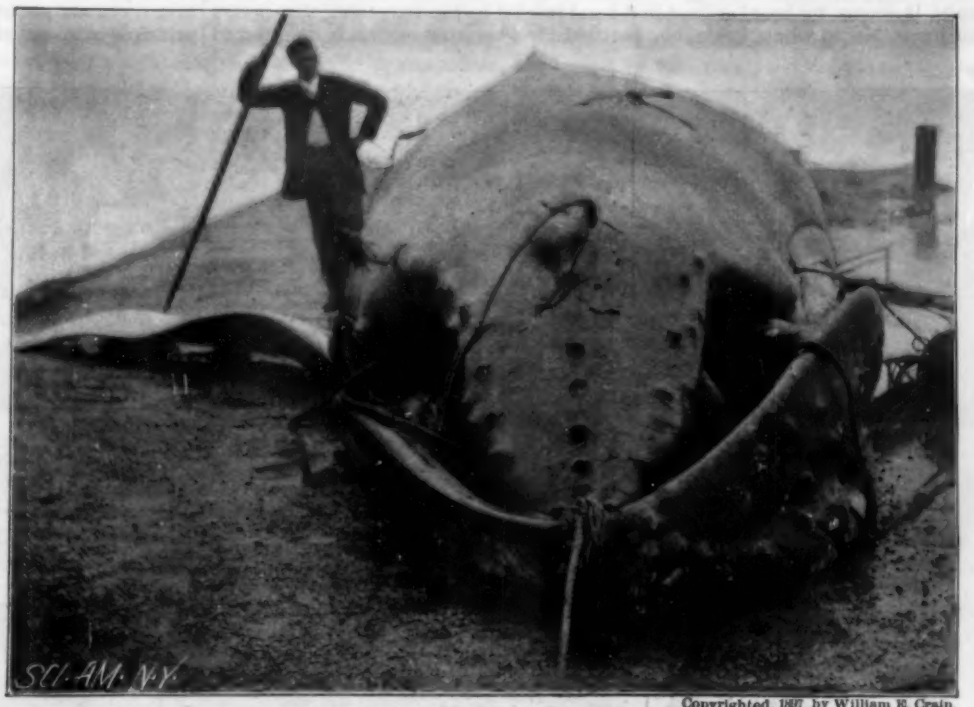
The Niger Exploring Expedition.

After an absence of three years, the expedition under Lieut. Hourst has safely returned to Europe from the Niger, says Nature. The party ascended the Senegal River, and then carried the section of an aluminum boat overland to the upper part of the Niger. On reaching this river the pieces of the boat were put together, and two native boats purchased. In these the expedition sailed down the Niger to Timbuctoo, where a stay of ten months was made. The voyage from Timbuctoo to Lokoja, at the confluence of the Niger and Benue, seems to have been arduous, but from that point the expedition was towed by a launch belonging to the Royal Niger Company to the coast at Wari. How much fresh topographical information Lieut. Hourst's party has obtained is not yet stated; this will depend on the highest point reached on the Niger. Reuter's message states that the expedition "first met the river Niger at Kayes;" but that town is on the Senegal River. There can be no doubt, however, that much valuable scientific information was obtained, for the expedition traveled slowly and was admirably equipped. One novelty was the use of a phonograph for reporting the native war songs. The expedition kept peace with the natives throughout the journey, in which it differs greatly from some of those previously conducted by French explorers in that region.

Raising a Drawbridge by Wedges.

A novel piece of engineering was done in Chicago on October 25, says the Railway Review, which was watched with much interest by civil and railroad engineers. The bridge over Clark Street was raised for the purpose of inserting new casters in the place of the old ones, which were so much worn down as to be at least two inches too small. Assistant City Engineer Roemheld, who had the work in charge, used a series of wedges in place of raising the structure by means of jack screws. The experiment proved an entire success. There were eighty of the old casters to be removed. The old system would have required that the bridge be lifted on jackscrews, so that all the casters could be taken out at the same time and the new ones put in their places. By the new method the work was greatly simplified and shortened.

The casters were so close together that it was impossible to place wedges between them which would be long enough to reach the required height at their thicker ends, unless the angle of the incline should be too great for the power of the bridge engine. To overcome this difficulty, applying the principle of inclined plane, Mr. Roemheld made his wedges in sections. Those used recently were in four parts, each about eighteen inches in length. The thinner sections of wedges were placed first in front of six of the old casters, separated at such intervals as to distribute the weight of the structure in the right proportion. Then the bridge was made to revolve, the six casters rose on the wedges and lifted the bridge free from the remainder of the old casters. When these had been taken away, there was room for laying the remaining sections of the wedges one after another, until the elevation of the bridge was sufficient to allow the placing of the new casters. When all the new casters had been placed for which there was room, the next move was to lower the bridge so that its weight would rest on the new rollers, relieving the six old ones that had done extra service, so that they might be removed. A crew of twenty men, under the supervision of Mr. Roemheld, worked through the daylight hours in changing the casters. Under the old system of work, it is estimated that the change could not have been effected in less than three days, and it would have required the erection of timber false work to accomplish it. In the work as done, not a stick of timber was used.



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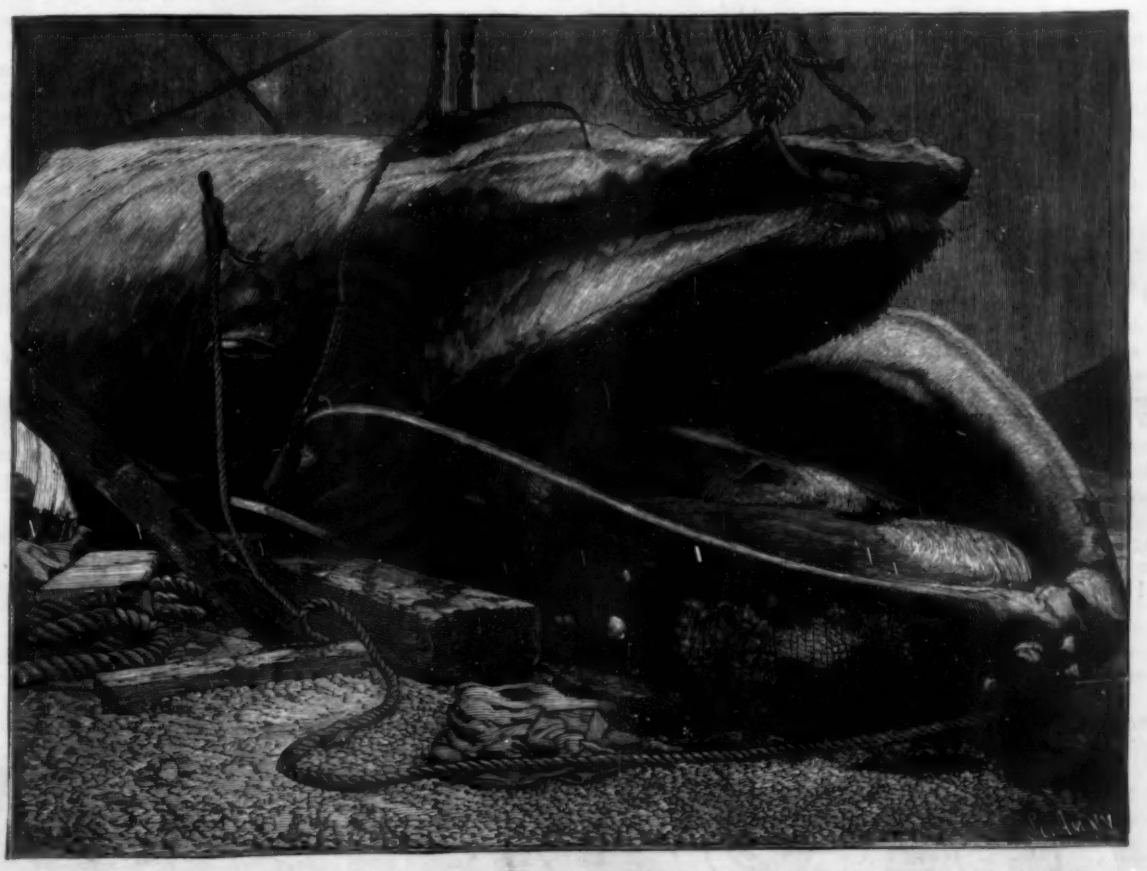
FRONT VIEW OF FIFTY FOOT WHALE CAPTURED IN PUGET SOUND, WASHINGTON, SHOWING THE FORMATION OF UPPER AND LOWER JAWS.



HEAD OF WHALE, SHOWING CAVITY OF THE MOUTH, WITH THE WHALEBONE BLADES AND FRINGE ON THE UPPER JAW.

CAPTURE OF A FIFTY FOOT WHALE IN PUGET SOUND, WASHINGTON.

Despite the multiplied number of subjects which are being gathered day by day within the field of the photographer's industrious and ever ready camera, there are some which even the omnipresent "Kodak" and its kind have failed to secure except on rare occasions. Of such an exceptional sort, surely, are the photographs of a newly captured whale from which the engravings which accompany the present article have been made. They were taken and forwarded to this office by Mr. William E. Crain, of Tacoma, Washington, shortly after the whale had been towed ashore, and it is probable that the engraving, which shows the huge mammal with its mouth opened, revealing the long hairlike fringe of the baleen or whalebone blades, is the first of its kind ever produced.

Not without much toil and frequent misgiving was the monster captured, for the hunters were inexperienced and the weapons inadequate, at least so it would appear from the local accounts of the hunt, which seems to have occupied, from the time the first assault was made to the hour at which the whale was finally moored in the harbor, just one week. The capture was mainly due to the efforts of four men in two small boats, who drove the first harpoon near the dorsal fin—not a fatal nor even a dangerous spot, as may be judged by the fact that they were towed for hours without the mammal being sensibly affected. They implanted other harpoons with little effect, and were subsequently joined by a small screw steamer which had rigged up a cannon on its bows for firing the harpoon. With this weapon a fatal shot was fired, the harpoon entering near the heart. It was estimated by the first captors that their boat was towed in all fully two hundred miles, and as the whale appears to have been moving constantly up and down the waters of Puget Sound for a whole week, the estimate is probably not exaggerated. The final effort in which the boats closed in on the whale is thus described by one of the hunters: "His only object seemed to be to evade his pursuers. This evasive work alone made the fight hazardous to us. With a mighty spout of water he would fluke and dive beneath the steamer, and rise upon the opposite side. We were in constant fear lest he might scratch his back on the hull and demolish the craft. When charged upon the starboard side of the boat, he would sound lightly and bob up serenely on the port side. Once in a while he would remain down a few minutes as if playing hide-and-seek, and then saucily show his dorsal fin astern, or ahead, and send up a rainbow of water as though waving a flag of defiance. The boats were not once attacked, and he would always maneuver to find a way to come up in open space, although he manifested no disposition to run straight away and beat a full retreat." The photographs, which were taken after the whale had been towed to the shore and beached, give a remarkably clear impression of one of these most remarkable of all creatures. All three engravings show it in the position it would occupy in the water, and not upon its back, as the curious appearance of the mouth might suggest to

those who are not familiar with the appearance of a whale.

The approximate measurements were as follows: Length over all, 50 feet; width of tail, 10 feet; thickness through the body, 12 feet; length of jaw, 17 feet. The captors believed that he was one of the rorqual species, which is said to be common on the Pacific coast, and to have a habit of entering inland waters; but, judging from the photographs, it seems to bear more of the characteristics of the humpbacked whale, so called by whalers on account of the peculiar shape of the dorsal fin. This species is distinguished also by the great length of the pectoral fins, and the fact that while the body is black, these fins are white, both of which characteristics are present in this specimen, as will be seen in the front view, which shows these fins extended. It is true the rorqual has the skin of the throat and underbody seamed with deep longitudinal furrows, but this is also a mark of the humpbacked whale, and is present in this specimen. These furrows appear on the fold of skin which in the engraving is seen pressed out under the left side of the lower jaw. Further marks that establish its species are the comparatively shallow upper jaw and the peculiar knoblike swellings which ornament or disfigure it.

The most interesting engraving is the wood cut which shows the interior of the mouth. The upper jaw is provided with a continuous row of closely packed whalebone blades, which are pendent from the roof of the mouth, and terminate in fine, long, brushlike ends. When the mouth is closed the fringelike ends of the whalebone lie in the channel-like space between the tongue and the sides of the lower jaw.

These act as a strainer when the mouth is open, and serve to retain the crustaceans and small organisms which form the food of these fish. The mouth is first filled with water, and then, as it is closed, the water flows through this natural sieve, leaving the nutritious matter behind. The expulsion of the water is completed by the raising of the tongue, which lies within the deep cavity of the lower jaw, against the roof of the mouth.

It should be stated that when the whale was being towed to the harbor it made a desperate resistance, and a veritable tug of war occurred between whale power and steam power, in which for a while the boat was held stationary. A glance at the huge tail and broad fins accounts for the high speed which the whale attains, and it is interesting to note that the flukes of the tail are very similar in shape to the latest type of propeller blades on a modern steamer.

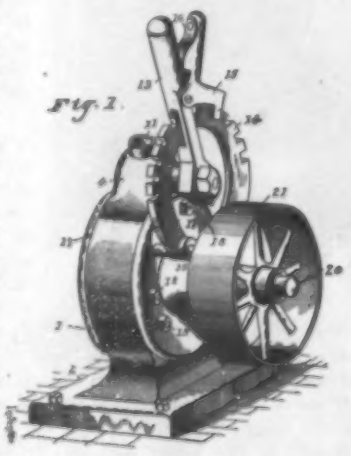
A FIFTY FOOT HUMPBACKED WHALE—VIEW SHOWING GREAT SIZE OF TAIL—TEN FEET FROM TIP TO TIP OF FLUKES.

THE BRAMBEL ROTARY ENGINE.

Last November the press of the country was informed by special telegrams that Mr. Grant Brambel of Sleepy Eye, Minn., had invented and patented a rotary engine for which he was offered at that time £320,000 ($1,600,000) from an "English syndicate." It was reported that the whole amount of the purchase money was paid over in cash and deposited in Chicago banks by the inventor. There are a number of variations of the story, of which the following is an example, the clipping being taken from the Chicago Daily Tribune:

"The engine does away entirely with the crank motion of the steam engine, a most desirable, but to all intents and purposes an impossible thing to do. The engine uses its own plunger for a cutoff. The engine is steam tight, and requires no ring packing. It can be made marine type, and of course can be either simple or compound.

"It is not a cheap machine, although it costs very much less than the ordinary engine. It weighs less and occupies only a fraction of the space of the old style engine. Mr. Brambel says: 'When anyone can build a fifty horse power engine that may be carried around in a hand satchel he has something that is very valuable, particularly when that engine is adapted to any and all kinds of work wherever power is used. The Brambel engine of fifty horse power, weighing less than a hundred pounds, may be attached to the end of the armature of a dynamo and all the belting done away with, or a Brambel engine not larger than a common saucer could be attached to a creamery separator, and set it whirling at the rate of 6,500 revolutions a minute. The largest of these engines, 250 horse power in size, is less than a foot wide at the base and eighteen inches high. It is in use in a dynamo room at Trenton, N. J., and the firm say they never had a more satisfactory machine. The patent was obtained a year ago, since which time several machines have been built and put into use.'"



The latest telegram that we have seen proceeds from Sleepy Eye, Minn., dated January 16, 1897. We quote from the New York Herald:

"The sale of Grant Brambel's rotary engine to the Allen syndicate, of London, England, has been consummated, and the Sleepy Eye inventor has letters of credit on the Bank of England for $6,700,000. The amounts paid were: For the English patent, $1,600,000; for France and Germany, $2,000,000; for the United States, $3,100,000.

"These amounts and the fact of the receipt of the letters of credit were verified by the inventor to-day when I called on him."

It is evident that the gentleman from Sleepy Eye is a very wideawake young person, and we take pleasure in publishing herewith an extract from his specification in which he describes the operation of the device. During the prosecution of the case some four patents were cited, one of which quite closely resembles the Brambel invention, and seems to depend upon the same general principle of operation. The extract reads as follows:

"Having described the construction of the improved motor, the operation thereof, briefly stated, is as follows: When the throttle valve is turned to admit steam or other motive agent to one of the inlet ports, said agent enters the cylinder adjacent to one of the expansion chambers, 25, and is thus admitted to one of the chambers or recesses in the piston. The expansion of the steam gives the impulse necessary to carry the piston in the direction indicated by the arrow (sic) in Fig. 2 a sufficient distance to bring the succeeding recess or chamber into the field of the incoming steam, the first named chamber being meanwhile exhausted at 12. The reversal of the motor is accomplished by moving the lever, 13, to cause the admission of steam through the other inlet port.

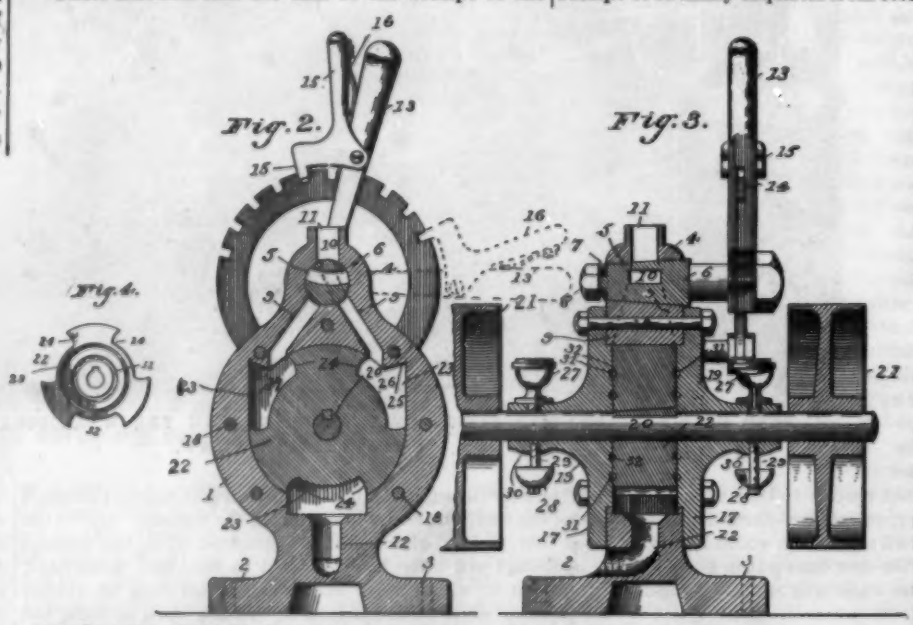
"It will be understood that in practice various changes in the form, proportion, and the minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of this invention.

"What I claim is—

"In a rotary engine, the combination of a cylinder having opposite heads provided with registering extended bearing boxes, inwardly divergent steam inlet ports communicating with the interior cylinder at their inner ends and a common valve casing at their outer ends, a cutoff and reversing valve arranged in said casing, a rotary piston arranged in the cylinder and provided with peripheral pockets adapted to communicate with steam chambers at the inner ends of said ports, registering cross-sectionally semicircular grooves formed in the contiguous faces of the piston and cylinder heads concentric with said bearing boxes, said grooves combining to form cross-sectionally circular lubricating ducts, a shaft mounted in said bearings and fixed to the piston, and lubricating devices in communication with the bores of said bearings, whereby lubricating material is adapted to pass between the ends of the piston and the cylinder heads and accumulate in said lubricating ducts to form packing to prevent the exhaust of steam or the passage thereof from one pocket to another of the piston, substantially as specified."

It had not been our intention to describe or notice in any way the above mentioned invention, but we are in receipt of so many inquiries from correspondents and so many requests for copies of the patent that we have decided it was best to state the facts of the case and publish reproductions of the patent drawings and copy the salient features of the specification and the claim.

We have not written to Mr. Brambel for any light on the subject of his valuable patent. We learn, however, that he is a telegraph operator, and we imagine that possibly his vocation may have something to do with the



THE "SEVEN MILLION DOLLAR" ROTARY ENGINE.

wide publicity which the story has attained. We do not know what object there is in foisting upon the public a story which is in such a high degree improbable. We do not need to go beyond the patent itself and its very narrow claim to discover the falsity of the rumor. The principle upon which the engine is operated is by no means new, while the claim confines the design to minute details of construction. If, as it is claimed, an English syndicate has purchased the patent at a price of some $7,000,000, is it not likely that before investing so vast a sum the patent itself would have been submitted to rigid examination as to scope and validity? We believe, therefore, that the story can be regarded in no other light than a hoax, and it is the object of the SCIENTIFIC AMERICAN to try and arrive at the truth of such matters. We desire simply to direct the attention of anyone who may be sufficiently interested in the story to examine into the merits of the case, and we believe that they will be satisfied with us that the whole matter is founded on baseless rumor.

THE TRAINING OF HORSES.

A military bicycle and athletic tournament in aid of a fund to endow hospital beds for the National Guardsmen of New York and vicinity was held in the Madison Square Garden, New York City, from January 11 to 16, and was attended by thousands of spectators. Great enthusiasm was shown at each performance when the military part of the programme was reached. By special permission, detachments of the regular artillery, cavalry and infantry, United States Army, gave exhibitions in which the skill of the soldiers was almost matched by the wonderful training and instinct of the horses. The drilling of Captain Dodd's Troop F, Third United States Cavalry, was especially fine, and General Miles says that the Cossacks, the Uhlans and Arabs can do no better. Captain Dodd found himself on a lonely post on the plains and set himself to the task of bringing men and horses to a perfect state of discipline. He did not allow the slightest approach to harshness toward the horses on the part of the men, and the great docility and perfection of drill has been brought about by kindness. The horses seemed to enter thoroughly into the spirit of the drill, and in the mock battles and the various evolutions they riveted the attention of the audience. The recent tournament will, it is thought, do much toward interesting people, not only in the regular army but in the training of horses as well. The exhibition of the cavalry troops, National Guard State of New York, was also very successful and showed what might be done where the horses necessarily had to be trained indoors, in armories or riding academies. The artificial gaits of the saddle horse are simply natural gaits which have been improved by a greater freedom in the movements of the shoulders and greater flexibility of the joints. A distinction is usually made between military and school trained horses and hunting and racing horses, as the latter receive their training out of doors and not under cover. The military horse must not only have a good temper, be obedient, speedy and quick to turn, but must be also accustomed to firing, music, flags, and, in fact, must not be afraid of anything. On the other hand, a horse trained in a riding school must be proficient in the acquired gaits by which the riding masters try to improve the natural gait. This teaching comprises maneuvers of two kinds. The first includes those in which the horse does not lift his feet any higher than in his natural gait, and the second in which both fore feet or all the feet are raised from the ground simultaneously. Our engraving shows a number of steps which are obtained by fancy training, both as taught by the riding schools and by the military trainers.

The "piaffe," shown in the lower left hand corner of our engraving, is the trot without movement, the animal lifting diagonally opposite feet simultaneously as in trotting; holding them in the air a moment and then putting them down into the same footprints without any sideways movement. The fore leg is raised until the thigh is almost horizontal, but the hind leg cannot be raised as high, owing to the formation of the joint. The piaffe is the expression of impatience by an eager animal unable to advance. This trot is a very effective one in processions.

The "passage," or Spanish step, is the piaffe in motion, a restrained trot, the name coming from the Italian word "promenade." The more regular and shorter the horse's step, the longer the foot is held in the air, the more perfect the results obtained. In this gait the step is much shorter than the ordinary gait, the ground covered by each forward movement being only about a foot. This enables the horse to make a slow oblique advance. Both the piaffe and the passage are especially useful for increasing the freedom of the movement of the shoulders of the horse.

The "terre-a-terre" is a gallop in two time, the fore and hind feet rising and falling alternately. This motion is the original of the toy rocking horse.

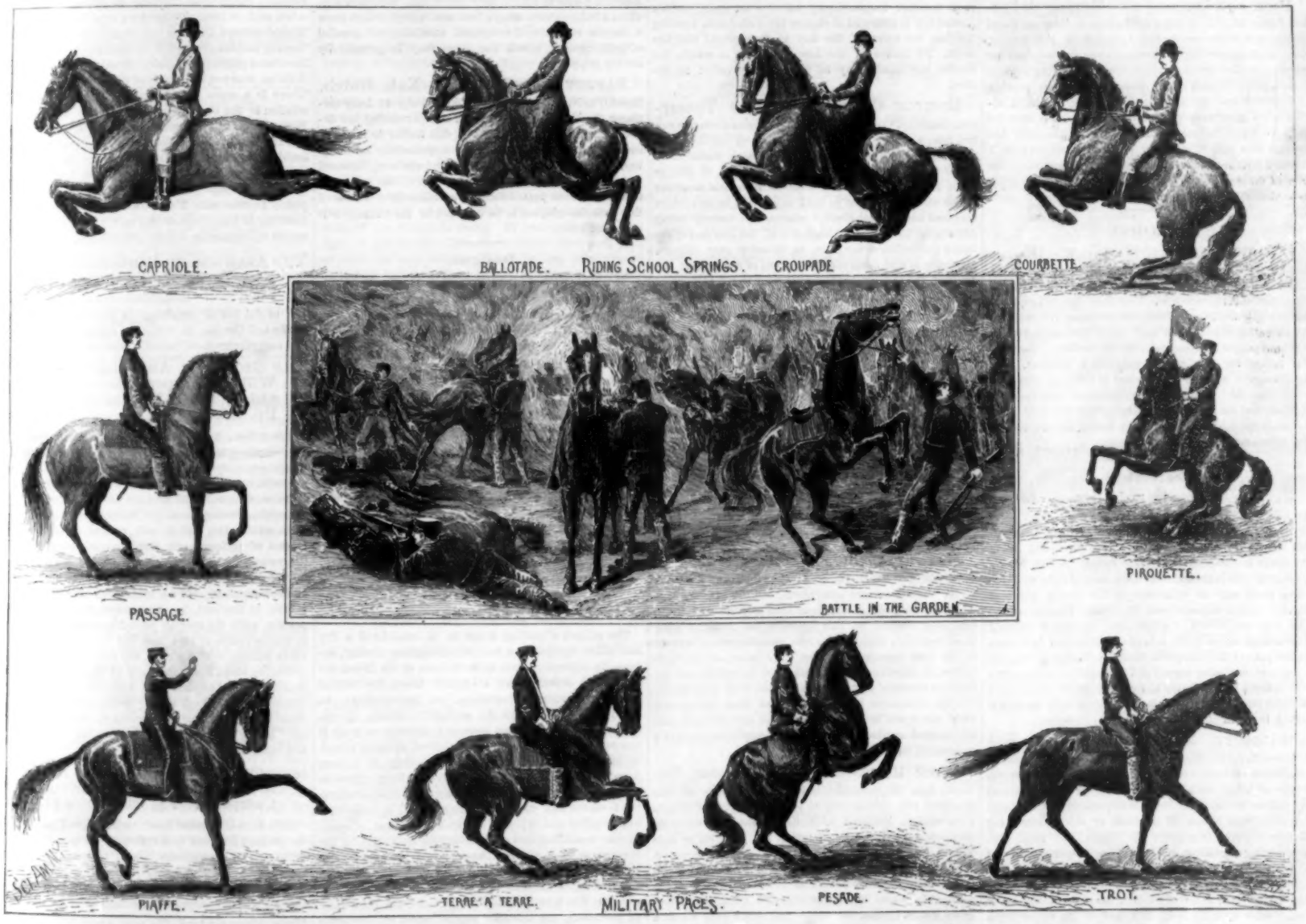
The "pesade" movement is the raising of the fore part of the body of the horse with the fore legs drawn under to such a height that the line of the back will form an angle of 45° with the ground. The body of the rider must, in this position, as in all of the manœuvers, be held perpendicular to the surface of the ground. The "pesade" is the first movement of the spring and jump. If, when the forward part of the horse's body begins to descend, he makes a short spring forward, then the term "courbette" is employed. In the "pirouette" or wheel, the horse turns in a circle, the diameter of which is nearly equal to the length of his body, the hind feet serving as the turning point around which he moves. The smaller the circle and the fewer the steps, the better. In this exercise the number of the steps taken by the hind feet must equal those taken by the fore feet.

The "croupade" is the first of three springs which belong distinctly to the riding school. In the riding school jumps the horse must land on his hind feet at all jumps, while in the military spring all four feet must touch the ground simultaneously, and in the hunting spring, the fore feet must land first.

In the "croupade" the horse raises the fore part of his body, and before it falls raises his hind feet, drawing them under his body, so that when they touch the ground again they have moved forward only about a foot. The higher the speed, the better the legs can be drawn under the body, and the nearer the line of the back approaches the horizontal, the more perfect the maneuver.

The "ballotade" and the "capriole" differ in the position of the hind feet, the horse alighting upon them in both jumps. In the "ballotade" the position of the fore legs is almost the same as that of the hind legs. In this exercise the horse does not draw his hind legs under him, but raises them so that the shoes show at the rear as if ready for a blow. The "capriole" is the highest and most complete of the riding school springs. When the horse has raised his fore and hind feet equally high and his back is almost horizontal, he thrusts his hind legs out with all the power at his command.

From the foregoing it will be understood that the three riding school springs are distinguished from one another by the position of the hind legs. In the "croupade" the legs are drawn under the animal's body, in the "ballotade" he raises his hind feet so that the shoes are shown as if ready for a blow, and in the "capriole" the hind feet are thrown out.



GREAT MILITARY TOURNAMENT RECENTLY HELD AT MADISON SQUARE GARDEN, NEW YORK.

GREECE has determined to have Olympic games at Athens every four years. The stadion is to be completed in Pentelic marble, M. Averoff, of Alexandria, who gave a million drachmæ to have the race course put in order, having promised to give half a million drachmæ ($100,000) a year for the purpose.

RECENTLY PATENTED INVENTIONS.

Engineering.

CENTRIPETAL TURBINE.—Leonce A. G. Mallory, Essonnes, France. To construct a turbine of high efficiency, in which the capacity of the buckets shall be always in constant proportion to the capacity of the distributer and the volume of water employed, without altering the inclined guides, is the object of this invention. A distributer having water passages encircles the bucket wheel, and fitting between the wheel and distributer is a cylinder having plates projecting outward within the passages of the distributer, there being also in the wheel a cone having plates projecting out and registering with plates in the passages of the distributer, the cone and cylinder being adjustable. The improvement may be applied to either vertical or horizontal turbines, with or without a cistern or tank.

PROPULSION OF VESSELS.—Frank O. Slanker, Pomona, Cal. According to this improvement a combined rudder and propeller are located at the bow and at the stern of the vessel, to be operated so as to give a maximum of speed and quickness in maneuvering. The rudder consists of a revolubie cylindrical casing closed at the top and bottom, and with side openings at angles to one another, while a partition has openings communicating with the side openings, and the propeller consists of a paddle in each compartment of the casing, the paddles having the same arrangement relative to the side openings and each of the paddles being capable of independent movement. The paddles are not reversed, whether the vessel is going ahead or backward, or in steering, as the direction of the vessel is entirely controlled by the casings.

PICK FOR DREDGERS.—Horace S. Potter, Jersey City, N. J. A pick having a long sectional shank, and which may be folded up out of the way of the working parts of the dredger when not required for use, is provided by this invention, the pick being worked from a point inboard on the dredger, and being capable of a vertical and lateral movement, to dig up a bank adjacent to the excavation when the earth is such that the buckets of the dredger cannot take it up. The pick has a hook like action, entering the earth and drawing it forward within reach of the buckets, and several picks may, if desired, be employed with one head on the outer section of the shank.

Electrical.

DYNAMO ELECTRIC MACHINE.—George L. Campbell, Kinsman, O. According to this improvement, the voltage and current are readily regulated while the dynamo is in operation. The field magnet supports are movable toward and from the armature, the magnets moving with the supports and being pivoted thereto to swing in planes longitudinal with the armature, there being means for holding the magnets in position. The field magnet sections are excited in the usual way, and when near the armature the voltage and amperage are highest, and are reduced by withdrawing the field magnet sections by simply turning a wheel, the current being increased by the reverse operation.

Mechanical.

CLUTCH.—Theodore J. Koven, Jersey City, N. J. This is a clutch which, when used on a drive shaft with a driving pulley, will turn the shaft but slowly at first, the rapidity of revolution being gradually increased to the regular speed. A disk having a recessed hub is mounted to slide on and turn with the drive shaft, and an extension of the loosely mounted driving pulley extends over the hub. Pivoted on the disk is an angle lever of which one member is adapted to enter the recess in the hub of the disk, and is located in the path of the extension from the driving pulley, the other member being curved and adapted to engage a pin which has a fixed relation to the lever, there being also a shifting mechanism whereby the clutch may be carried out of the path of the driving pulley extension.

GRINDING LATHE.—Frank P. and Charles M. Kuhn, Kearney, Neb. To grind the sickles or blades of lawn mowers and harvesters, etc., or the blades of other machines, these inventors have devised a machine in which the stone is adjustable to the blades from the front instead of the back or sides, there being fingers or guides to support the blades, and these supports being adjustable to admit of the proper grinding of different shapes of blades to different angles. The guides or fingers also have adjustable shoes with which the blades come in direct contact, the shoe of the lower finger supporting the blade and that of the upper finger preventing it from flying upward from contact with the stone.

DRILL RELEASING TOOL.—Richard Nethell, Calumet, Mich. In drilling machines actuated by compressed air, steam, or other means, this invention provides means by which the operator may easily release and loosen the drill should it become stuck in the work. The tool for doing this has a hook with angular opening at one side and a transverse opening near the hook, a key or wedge in the opening extending partly across the opening of the hook. When the releasing tool engages the shank of the drill, and the shank is fastened in position by driving in the wedge, a drill that is stuck fast may be released by turning on or lifting the handle.

NUT LOCK.—Ellsworth G. Nicodemus and Cyrus C. Guisinger, Canal Winchester, O. The bolt, according to this improvement, has a slot on one or two sides in its threaded end, the slots being engaged by lugs on a washer resting against the article to be secured, the washer having a ratcheted upper face. The nut has a passage parallel to the bolt, in which is a spring-pressed pawl adapted to engage the teeth on the outer face of the washer, the handle of the pawl traveling on an inclined top portion of the nut, whereby it may be lifted out of or moved into engagement with the ratchet teeth, the nut in the former case having free movement and in the latter case being locked with the washer on the bolt.

SPRING MOTOR.—Francis A. Burrows, Columbia, S. C. This is a motor for sewing machines and other light machinery, of such construction that the motor is wound up for work by the weight of the operator sitting down, and when the motor ceases to run it may be again set in operation by the operator simply rising from the seat and sitting down again. In a suitable casing is a drive shaft on which is a loose gear wheel, a helical spring having one end fixed to the drive shaft and one end to the gear wheel, while a loose disk on the drive shaft has a flexible connection with a lever carried by the casing, the loose disk having a pawl engaging a ratchet disk.

Agricultural.

PLOW ATTACHMENT.—Patrick E. Graham, Millwood, Minn. This improvement comprises a frame attached to and adapted to travel in front of the plow, and carrying a traction wheel and a separating and distributing wheel, with trailer arm, the attachment being designed to facilitate the separation and distribution of manure or fertilizer in advance of the plowshare, and to hold the manure or fertilizer down at the land side of plow, also holding the manure on the sod while it is being turned into the furrow. The attachment is especially adapted for covering manure, straw, high stubbles, grass, etc., over the ground that is to be plowed, in advance of the plow.

Miscellaneous.

BICYCLE HANDLE BAR.—John A. McCollum and Edwin J. Knoll, Riverside, Cal. This patent is for an improvement in handles whose arms are adjustable, that they may be placed in different positions or angles. Pivotally connected with the stem are lateral arms having gear faces meshing with gear faces on a rack movable longitudinally between the arms, while a forked key is arranged to engage the rack teeth, a spring holding the forks of the key to engagement with the teeth. By means of the key the angle at which the handle bar stands may be conveniently varied as desired.

BICYCLE CANOPY.—Thomas Thompson, Danbury, Conn. To protect the rider from the sun and rain, a readily removable canopy cover has been devised by this inventor, which may be closely folded to be out of the way when not in use. The canopy, of silk or other fabric, is removably secured on a light stretcher frame which is detachably held in position by an upright standard and a novel bracket clamp, the canopy being adjustable to incline to either side of the bicycle for the better protection of the rider, as occasion may require. Provision is also made for the support of a mirror at the front of the canopy, enabling the rider to see objects at either side and in the rear.

HAT MARK.—Joseph S. B. Hartsock, Washington, D. C. This is a cheap attachment to be secured to the sweat band to indicate ownership, and also to indicate the mistake by pricking the forehead of a stranger on whose head the hat is inadvertently placed. It is made of thin stamped metal and attached to the sweat band, in normal position projecting upward therefrom inside the hat, but when the hat is taken off the head and hung on a rack the mark is bent down over the sweat band, and has at its lower edge prickers or prongs insuring attention should the hat be mistakenly placed on the head. This hat mark is also designed to bear the advertisement of the maker or dealer, and be so inexpensive that it will be furnished free with hats purchased.

MATERIAL FOR SHIELDS.—Edward C. Gerstenberger, Brooklyn, N. Y. A composition designed to be bulletproof and waterproof, and which may also be readily shaped, cut and bent into any desired form, has been devised by this inventor, the material being more especially designed for the manufacture of armor, covers and numerous articles. It is made of alternate layers of fabrics, one consisting of hair cloth and the other of sheets of gutta percha silesia, with a minutely divided substance between them, as alum and ground glass, the layers being united by heat and pressure, and any desired number of layers being employed to form a material of the desired thickness.

ROPE REEL.—John B. Crowder, Tuscaloosa, Ala. To conveniently hold several sizes of rope in stores, etc., this invention provides a reel of simple construction, arranged with means for automatically measuring the rope and registering the quantity as it is wound on the hanking reel from the supply wheel. A suitable tension device for the rope is provided, and an alarm indicator is sounded at every revolution of the measuring wheel, the registering bar being simultaneously moved so that the buyer and seller may see at a glance how many yards have been measured off.

FRUIT CANNER.—Anna C. McCutcheon, Sparta, Mich. According to this improvement, instead of cooking the fruit before canning, the fruit is first put in the cans and the latter are placed in a specially designed steamer, whereby the fruit may be cooked by steam, retaining more perfectly its full flavor and color. The body of the steamer is removably placed in a boiler pan adapted to be set on a stove, and a short distance above the water is a perforated diaphragm on which cans may be set, there being another perforated diaphragm a short distance higher up within the casing, on which cans may be set and to which steam is supplied by a central pipe and branch pipes, maintaining an equal heat in the upper and lower sections.

AIR DUCT CLENCH COUPLING.—Edward J. Mallen, New York City. According to this invention, air ducts and couplings may be made in the shop to be readily erected in place by an inexperienced operator, the couplings being so secure as to prevent leakage and the coupling bracing and strengthening the duct. The coupling consists of a U-shaped channel piece, one side member of which has an outwardly bent parallel tongue, the latter being clamped on the inner face of one member of the duct, the other member of which is flanged at the ends so that the various flanges of a rectangular duct will enter the U-shaped portions of the coupling, when the outer members are bent down to form an airtight connection.

SCRAPER.—William Owsley, Twin Bridges, Montana. A number of scoops or scrapers, according to this invention, are connected in one gang, by means of a spacing bar at the front and one at the rear so that the scrapers act simultaneously in taking up and dumping material, thus cheapening the cost in labor and power in any considerable job of grading or filling. A connected front and rear draught rope or cable serves for moving the scraper forward or backward, by any preferred form of motor.

WAGON BRAKE.—Laurens S. Wheeler, Tyro, Kansas. According to this improvement the brakebeam is held to slide on guide plates just forward of the rear axle, the beam and its shoes being held away from the wheels by springs and drawn rearward into operative position by links pivotally connected to the lower ends of arms on a transverse rolling shaft. The upper ends of the arms are connected by links and rods to the rear axle, and the right hand end of the rolling shaft has an upwardly extending crank arm, from which a rod extends forward, on the outside of the wagon body to a pivotal connection with levers carrying a pawl engaging a curved ratchet bar. The construction is such that the brakes may be easily and quickly applied.

WINDOW CLEANING PLATFORM.—Henry G. Wilmerling, Brooklyn, N. Y. Connected with this platform is a locking bar, and a socketed keeper adapted for attachment to the window sill receives and locks the angular terminal of the locking bar. The improvement provides for the safe cleaning of the outside of windows of tall buildings, and the platform, when not in use, may be folded to occupy but small space, it being also readily moved from place to place.

TICKET HOLDER.—William S. Lodge, Albany, N. Y. To facilitate the display of tickets, cards or signs, on counters, shelves and other places near the goods to which they refer, this invention provides a holder comprising a base and upright bent from a length of wire, the upright consisting of parallel strands against which the signs may be pressed by sliding grippers.

SAFETY BABY HOLDER.—Kate Hatch, Brooklyn, N. Y. To safely hold a baby in baby carriages, chairs, swings, etc., while also permitting the desired freedom of the entire body, this holder is made of netting fashioned to form a pocket open at the front and top, the upper ends of the netting strands being fastened to a belt to be secured around the waist of the baby and their lower ends passed through apertures in a bottom of thin material adapted to be fastened to the carriage bottom, chair, etc.

Designs.

MUSTACHE GUARD.—Charles Weller, Newark, N. J. This device has an oval-shaped body, with opposing side edges transversely curved in an outwardly direction, there being upwardly extended hooks at each end of the body.

CLOCK FACE.—Charles A. Cornibert, Woodside, N. Y. According to this device, shells are represented laid on a circular tray to correspond to the numerals of a watch, the shells carrying figures representing the hours, and a knife and fork representing the hands.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE EARTH AND ITS STORY. By Angelo Heilprin. New York and Boston: Silver, Burdett & Company. Pp. 267. Price $1.25.

The subject of geology is apt to be considered a dry and rather repellent one for the elementary student, because its beginnings have hitherto been of the rather uninteresting order. After a student knew his natural history, chemistry, mineralogy, and palæontology, he could begin to appreciate the geologist's science, all-embracing in its scope. Just because it included so much it was rather an object of dread. In Prof. Heilprin's work we have a genuine revelation, for geology is at once popularized and made a unit of; it is no longer given as a dry and difficult conglomeration of abstruse sciences, but is shown as a most interesting whole; as something to be studied and enjoyed by all; as a subject of really literary treatment, and one illustrated strikingly for the observer at home as well as abroad, and not only afar off but in easily accessible regions. The impression produced on the mind of one who has studied geology in the old school is that here the classic labors of Dana, beloved by all geologists, are worthily supplemented by Heilprin's work; which to the old time student is in the nature of a revelation. The topics are illustrated by reproductions of natural scenery from accessible places, Maryland, New Jersey, Pennsylvania and the like, as well as the wilder regions of the West and of distant Europe. Travelers in Switzerland will find that country laid under tribute, and for them the work would have a distinct value. But the same is to be said for travelers elsewhere, for this book will enlighten observers everywhere. Thus the pretty view of Interlaken tells the story of how Lakes Thun and Brienz were once one; lake terraces are shown in the view of the vicinity of the Great Salt Lake in this country; and glacial action is illustrated in a most striking series of views from both hemispheres. One charm of the book is that while the world is laid under tribute for the illustrations, they are selected from comparatively well known regions, making geology a science of the present time and place, not of the remote only. The palæontological plates, some engraved and some processed, are excellent. Perhaps a little fuller definition or explanation of some technical terms might be wished for. As an example, we would cite the term "strike;" this might be advantageously defined for the benefit of the beginner. This is about the only criticism which a somewhat close examination of the book has suggested to the writer. The work is one which once begun will be read to the end.

THE SURVIVAL OF THE UNLIKE. By L. H. Bailey. New York: The Macmillan Company. Pp. 515. Price $2.

A collection of evolution essays suggested by the study of domestic plants is here presented, with a large amount of speculation, the exposition of some original methods of research, and quite a collection of facts relating to plants and animals which the author claims to have heretofore been "almost wholly overlooked by students and philosophers." The "nature of the divergence of the plant and the animal" is the starting point from which the writer proceeds to discuss the leading problems associated with the variation and evolution of cultivated plants.

"FIELD FLOWERS." Chicago: Published by the Eugene Field Monument Fund Committee. Price $1.

This is a unique publication, designed as a souvenir of one of the sweetest poets of the present generation, the late Eugene Field, and for the purpose of creating a fund the proceeds of which will be equally divided between the family he left and the building of a monument to his memory. The pages are illustrated by original drawings of a large number of eminent artists, and the text of the matter consists of selections of the writings of Eugene Field. It is an exquisitely beautiful and tasteful little monograph. Subscribers to the book are asked to send ten cents extra for postage.

THE STUDY OF ARCHITECTURE: AN OUTLINE OF THE STYLES IN ALL COUNTRIES. By Charles Thompson Matthews, M.A. New York: D. Appleton & Company. 1896. Pp. xvi, 468, 235 illustrations. 12mo, cloth. Price $3.

There seems to be a steady demand for elementary books on architecture, four having appeared in a short time. Mr. Matthews has given a sketch of architecture from the time of the pyramid of Cheops to the modern skeleton frame steel building in Chicago. Of course, when such an extensive territory is to be covered, only a limited amount of space can be given to each style; still it really seems as though more than fourteen pages might have been given to the Italian Renaissance, furnishing as it did so many of the motifs of the architecture of to-day. There is a mere mention of Arnolfo di Lapo, whose relation to the First Renaissance is the same as that of Bramante to the High Renaissance. The section on American architecture is excellent, as is that devoted to ancient architecture, which fills half the book. The illustrations are well chosen, though it would have been as well if their source had been indicated. Many of them are poorly reproduced. The work will doubtless prove interesting to many who do not care to purchase the larger works of Fergusson, Lübke, Sturgis, etc.

THE ARCHITECT'S DIRECTORY, 1896-1897. New York: W. T. Comstock. Price $1.

A useful list of architects in practice in the United States and Canada, to which is added a list of dealers and manufacturers of building materials.

THE STORY OF AMERICAN COALS. By William Jasper Nicolls. Philadelphia: J. B. Lippincott Company. Pp. 405.

The writer, a member of the American Society of Civil Engineers and author of the Railway Builder, after fifteen years of employment in the coal fields of Pennsylvania, endeavors in this work to supply a complete epitome of facts for all who are seeking information on the origin, development and business in coal. The book has a good index, and is well printed. The subject is treated of in four main divisions—the origin, including the geology, geography, and classification of coals; the development, covering mining operations; transportation, and consumption. The average price of coal at the pit mouth, in England, in 1894 is said to have been $1.60 per ton, while the average price for the same kind of coal in Pennsylvania in 1894 was but 74 cents, the Pennsylvania miners working only 165 days in the year, and averaging about four tons daily at 35 cents a ton. The author does not explain why, with this low cost of production and the high selling prices, as compared with those in England, our coal operators and coal railroads are "losing money," while the English coal operators and carriers are making a steady profit.

QUINCE CULTURE. By W. W. Meech, A.M. New York: The Orange Judd Company. Pp. 180. Price $1.

This is an illustrated hand book designed to facilitate the propagation and cultivation of the quince, with descriptions of its varieties, insect enemies, diseases, and their remedies. The author has made the cultivation of the quince a specialty through many years, and the work, therefore, has exceptional practical value.

THE FISHERIES, GAME AND FORESTS OF NEW YORK STATE. Report of the Commissioners. Albany, N. Y.

A beautifully printed quarto, with exquisite colored and gelatine illustrations, and many fine half tones, is the form in which is presented the First Annual Report of the Commissioners of Game and Forests of New York State, for the period commencing with its organization, April 25, 1895, to September 30, 1895. The book is a highly creditable specimen of printing from the Wynkoop Hallenbeck Crawford Press, New York and Albany. The commissioners are Barnett H. Davis, president, Palmyra; Henry H. Lyman, Oswego; William R. Weed, Potsdam; Charles H. Babcock, Rochester; Edward Thompson, Northport; and Franklin B. Mitchell, secretary, Albany, N. Y., and in their direct service are a State fish culturist, a superintendent of hatcheries, a superintendent of forests, and game protectors and foresters. The report also furnishes a valuable compilation of the fisheries, game and forest law of the State. The report of the superintendent of hatcheries shows that during the year prior to September 30, 1895, there had been planted in the waters of the State 196,247,840 fish of various kinds, 17,307,040 fish fry and eggs being contributed by the United States Fish Commission. This is more than three times the quantity distributed in 1891, and greater by sixty millions than the entire fish plant for the year ending in September, 1894. The law prohibits the Commission from distributing fish or fry to private owners in the Adirondacks or elsewhere, so that the entire benefit of the fish plant will accrue to those who angle in the preserved waters of the State. The colored illustrations reproduce with great accuracy and finish of execution various pecimens of game fish.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Marine Iron Works. Chicago. Catalogue free.

High grade well drills. Loomis Co., Tiffin, Ohio.

For hoisting engines. J. S. Mundy, Newark, N. J.

"U. S." Metal Polish. Indianapolis. Samples free.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Handle & Spoke Mchy. Ober Lathe Co., Chagrin Falls, O.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Spring & Varick Sts., New York.

Concrete Houses — cheaper than brick, superior to stone. "Ransome," 737 Monadnock Block, Chicago.

Machinery manufacturers, attention! Concrete and mortar mixing mills. Exclusive rights for sale. "Ransome," 737 Monadnock Block, Chicago.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7092) C. E. B. asks how to make a paste or glue that will answer to paste a photograph or lithograph on glass, and not to show the paste, and how to treat same. A. To mount prints take 4 ounces gelatine and soak half an hour in cold water, then place in a glass jar, adding 16 ounces of water; put the jar in a large dish of warm water and dissolve the gelatine, add a small quantity of glycerine, say 1 ounce. When dissolved pour into a shallow tray. Have your prints rolled on a roller, albumen side out; take the print by the corners and pass rapidly through the gelatine, taking great care to avoid air bubbles. Hang up with clips to dry; when dry squeeze carefully on to the wet glass. The better the quality of glass, the finer the effect.

(7093) G. G. W. asks for a copper polish to be used for cleaning the work board in a saloon. Until lately I have been able to buy a polish that answered all requirements, but am unable to get it at present. It was a powder of a reddish cast and required no rubbing whatever. Could you give me an idea as to its composition? Have tried bichromate potash and pumice stone and got nearly the same action, but it stained the hands. A. Rub the metal with rottenstone and sweet oil, then rub off with a piece of cotton flannel, and polish with soft leather. A solution of oxalic acid rubbed over tarnished brass soon removes the tarnish, rendering the metal bright. The acid must be washed off with water, and the brass rubbed with whiting and soft leather. A mixture of muriatic acid and alum dissolved in water imparts a golden color to brass articles that are steeped in it for a few seconds. The red powder you mention is probably rouge.

(7094) S. F. asks: Will you please a constant reader of your valuable paper by answering the following question? Is there a cement that is insoluble; in other words, a cement that will not liquefy with heat? A. The following are formulas for fireproof cements. Our correspondent fails to give the use to which the cement is to be put, which is necessary to give a formula which will apply. 1. Iron filings, 140 parts; hydraulic lime, 30; quartz sand, 25; salammoniac, 3. These are formed into a paste with vinegar, and then applied. The cement is left to dry slowly before heating. 2. Iron filings, 180 parts; lime, 45; common salt, 8. These are worked into a paste with strong vinegar. The cement must be perfectly dry before being heated. By heating it becomes stone hard. 3. Linseed or almond meal, mixed to a paste with milk, lime water, or starch paste, resists a temperature of 500° Fah. (260° C.). 4. Clay is puddled with water, and to it is added the greatest possible quantity of sand, which has been passed through a hair sieve; the whole is worked up in the hands, and applied in coats more or less thick on vessels needing protection from the direct action of the fire. 5. 1 part of sifted manganese peroxide, 1 part pulverized zinc white, sufficient commercial soluble glass to form a thin paste. To be used immediately. Becomes very hard, and presents a complete resistance to red heat and boiling water. 6. As a coating for glass vessels, to protect them from injury during exposure to fire, pipe clay and horse dung are made into a paste with water. This composition is applied by spreading it on paper; it is used by pipe makers and will stand the extreme heat of their furnaces for twenty-four hours without damage. 7. Shredded tow or plumbago is substituted for the horse dung. 8. Clay, 5 parts; iron filings, 1 part; and linseed oil varnish q. s. to mix. 9. 10 parts common clay dried and pulverized; 4 parts iron filings; 1 part common salt; 1 part borax; 2 parts manganese peroxide.

(7095) H. J. F. asks: 1. If I build dynamo illustrated in SUPPLEMENT, No. 600, twice the size given, what will the production be? A. The power of a dynamo should vary with the fifth or sixth power of its lineal dimensions. The power of dynamos of lineal ratio 1:2 should be 1:32 or 1:64. It would be safer to take the mean, say 1:48. 2. I wish to build a 25 light dynamo; what type would you recommend? A. The bipolar dram armature type such as given in our SUPPLEMENT, Nos. 600 and 865. The latter for 75 lamps is highly recommended. 3. Can I obain drawings in detail of either an Edison or Westinghouse dynamo of about 25 or 50 lights? A. The nearest we have is the SCIENTIFIC AMERICAN dynamo in SUPPLEMENT, No. 865, just alluded to. 4. I wish to make a volumeter. Can you furnish me a SUPPLEMENT describing same? A. See our SUPPLEMENT, Nos. 353, 552, 556; for alternating current see Nos. 668, 734, 993. 5. Can I remould carbons by first pulverizing and adding a solution to make a paste and then baking them? A. The manufacture of moulded carbons is described in our SUPPLEMENT, No.

(7096) W. C. asks what calcium tungstate is that is used for X ray fluorscopes. A. It is a white, somewhat crystalline or granular salt, made by heating together sodium tungstate and a calcium salt, such as calcium chloride. By treatment of the cooled mass with water the sodium salt formed is dissolved, leaving the insoluble calcium tungstate. Its formula is $CaWO_4$.

(7097) B. M. asks how the copper deposit on carbon stick is put on. Can the same be done with graphite? If so, how? A. It is put on by electric deposition, just as any article is copper plated. The same cannot be done with loose graphite, on account of the impossibility of avoiding "electrolytic soldering" or joining of the particles by the copper deposit.

(7098) A. B. W. asks how to arrange to operate an ordinary 3 inch electric elevator bell from a motor circuit. The elevator is run by an electric motor using a 500 volt circuit and it is desired to take off about 5 volts of this current to operate the bell; will this be practical? If so, how can I construct a simple, inexpensive, and efficient resistance box, which I suppose is necessary for the bell circuit? How much resistance will be required, and of what material? A. The best plan is to take off the current in shunt. By testing find two portions of the circuit sufficiently removed from each other to work the bell satisfactorily, if its line terminals are connected thereto. There will be no trouble in finding such points unless the line from street to motor is very short. A resistance box on so high a voltage is not advisable. If this cannot be done, the resistance can easily be calculated.

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JANUARY 12, 1897,

AND EACH BEARING THAT DATE.

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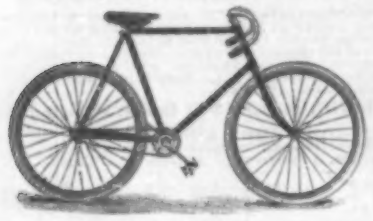

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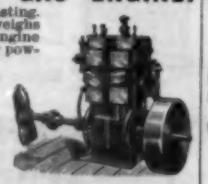

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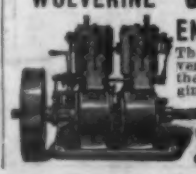

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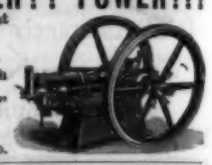

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